Subterranea

The Magazine for Subterranea Britannica

Subterranea Britannica **December 2019 Issue 52**

IN THIS ISSUE

NAHMO 2019
ROC 28 Group Awards
Private Bunker Exercise
Earthquakes and underground places

Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The society is open to all and its membership includes all walks of life. Members are invited to contribute to this magazine even if this just means sending very welcome snippets from newspapers and magazines.

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Front cover photo: *Level Fawr at Pontrhydygroes. This great cross-cut, the longest adit in mid-Wales, drained four major lead mines and intersected twelve lodes. Around 1872, the 118 fathom level of one of these mines, Glogfach, broke into Level Fawr some 16 feet above its floor level, and was re-engineered to drain into the latter. Richard West is seen ascending the 'step' up from Level Fawr, doubtless grateful for the very modest water flow that morning. At this point he is decidedly subterranean: about a mile from the adit's portal and over 700 feet below ground level. Photo Tim Wellburn*

Back page upper: *Having participated in a day-long exercise at Nick Gould's private bunker in Somerset to experience how a local authority bunker might actually have worked in the 1980s, the Sub Brit party are safely back at the surface and still smiling; the team survived the exercise, possibly saved by tea and medals. . . . . and wine! Photo Clive Penfold*

Back page lower: *The 1899 corrugated iron dressing mill building at Cwmystwyth is seen in May 1984. The mill was demolished a few years later. An elevated incline from Level y Ffordd passed alongside the building. The mill was located to the west of Level Fawr. Photo Nick Catford*

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The committee of Subterranea Britannica and the Editor do not necessarily agree with any views expressed and cannot always check the accuracy of any material sent in.

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Chairman's Welcome

Martin Dixon

I'm sure all members will join me in congratulating Nick Catford on being appointed an Honorary Member of Subterranea Britannica. Nick tendered his resignation from the Committee at our last meeting and we unanimously voted to give him Honorary Membership in recognition of his huge contribution over the years to underground recording and to Sub Brit.

Nick's excellence as an underground photographer is plain to see, both in *Subterranea* and across many locations on our website. He has arranged trips for members and has visited every known ROC Post across the UK. His interests are as broad as they are deep; he also has an amazing memory for sites and visits that often comes in useful – literally a mine of information. Nick's publications include the superbly illustrated trio of *Secret Underground London*, *Cold War Bunkers* and *Burlington* which I'm sure have pride of place on many members' bookshelves.

I'm delighted that Nick will continue as *Subterranea* Editor, leading the team that make this publication such a superb production.

For many years Nick has also been Membership Secretary and I'm pleased that Richard West has agreed to pick this role up. Tim Wellburn has in turn agreed to fill the post of Vice-Chair (both roles to be ratified at the AGM).

Talking of membership, by the time this is published we will have moved to a new membership system. The previous system has taken a lot of support and hand-holding from Richard Seabrook our Webmaster; the new system should be much more robust and includes contracted support from the suppliers. At the same time we'll move to a new event booking system. Richard has worked hard behind the scenes to ensure appropriate data is transferred across and I'm sure the new platform will serve us well.

Our Autumn Conference at Reading was a great success with some fascinating presentations. We haven't decided whether to use the venue again but if we do then we'll try to arrange a visit or two on to make the journey worthwhile to those more distant members. The location for our Spring Meeting and AGM on 25 April will be the Metropolitan University in London and the excellent programme of speakers is already confirmed (see elsewhere in this edition). Please tell your friends and book early as this gives us chance to arrange catering for the right numbers.

Arrangements are in hand for a study weekend in Oslo in May next year. Our visit will coincide with the 75th anniversary of Liberation Day and we hope there may be special celebrations in which we can share. Sites will include the legendary Heavy Water Plant at Vemork Power Station successfully targeted by the Norwegian Resistance and the SOE in World War II. Thanks to Lars Hansson (who organised previous great Sub Brit trips to Stockholm, Gothenburg and Copenhagen/Malmo) for making the local arrangements for us.

As ever, grateful thanks to all members who contributed during the year and helped make Sub Brit the great place it is. I'm looking forward to seeing many members at events throughout 2020; until then, Season's Greetings and may all your New Year Resolutions give you 2020 vision.

chairman@subbrit.org.uk

Oscarsborg, one of the sites to be visited during the Oslo study weekend in May 2020

SUBTERRANEA BRITANNICA DIARY

Summary of Forthcoming Events

Sub Brit specific events

2020

8 February Committee Meeting

1 March Copy deadline for *Subterranea* 53

25 April AGM and Spring Meeting, Holloway, north London

30 April *Subterranea* 53 published

8 – 11 May Oslo Study Weekend, Norway

1 July Copy deadline for *Subterranea* 54

31 August *Subterranea* 54 published

17 October Autumn Meeting, Sywell, Northamptonshire

18 October Sub Brit visits around Northamptonshire

1 November Copy deadline for *Subterranea* 55

Mid-December *Subterranea* 55 published

Other underground-related events

2020

3 – 6 April NAMHO Weekend (Cornwall)

20 – 27 August Association of Industrial Archaeology Conference, Liverpool

For web links to these events please visit *www.subbrit.org.uk/events*
or contact the organisation concerned

If you know of other relevant events run by other societies, please let us know so that they can be advertised in the next edition and on the website

NEWS

Miscellany compiled by Paul W Sowan and Nick Catford

CONSERVATION AND HERITAGE

Chatterley Whitfield colliery 'at risk', Staffordshire

Chatterley Whitfield colliery near Stoke on Trent has been flagged up by the Victorian Society as 'at risk'. This was the first British colliery to mine over a million tons of coal a year. After it was closed, the mine became a museum and tourist attraction, with an extensive if not complete range of surface buildings and guided tours underground, by way of the original deep shaft. The underground tours remained possible as long as a nearby mine was still at work, with pumps removing water.

When the nearby mine closed and the pumping ceased water levels rose in both mines, making deep-level underground tours impossible: there was also an issue with methane gas displaced upwards by the rising water. Guided tours were then continued in reasonably convincing simulated mine galleries built in a disused railway cutting. Eventually the mine closed to visitors in 1993.

The entire mine is a Scheduled Ancient Monument, but with severely reduced central Government funding survives on little more than a minimal 'care and maintenance' basis. A complete large coal mine surviving into the 21st century, undoubtedly of great historic importance for a country which pioneered the industrial revolution and the development of railways worldwide, Chatterley Whitfield deserves a better fate than merely an entry on an 'at risk' register.

Your scribe enjoyed a visit including the deep-level tour probably in the 1980s, using a bargain ticket which included return rail travel from Euston to Stoke, a bus connection to the mine, and entry to the site and deep-level tour.

SOURCE: BROWN, Mark, 2019, Alarm over plan to let crumbling heritage disappear. *The Guardian*, 13 September 2019, page 28.

Creswell Crags given special Heritage Award

Creswell Crags has been given a special heritage award after rare 'witch marks' were discovered by Sub Brit members during an official visit to the site last year (see *Subterranea* 51, August 2019).

The museum and prehistoric gorge received a special judges' award in the Regional Heritage Awards for 'taking an enterprising approach to the discovery of the witch marks'. Following the discovery and subsequent global publicity, the site had its 'best February half-term yet' earlier in the year as thousands descended for sell-out tours of the find.

Sub Brit's Ed Waters with some of the witch marks he indentified

The collection of 18th-century 'apotropaic' marks, which were previously dismissed as graffiti, were discovered in the Crags' caves in February and are thought to be the largest assemblage of witch marks in the UK. Superstitious inhabitants of post-medieval Creswell are believed to have etched the frenzy of letters, numbers and patterns on the cave walls to protect against witches and curses.

Speaking at the time, Paul Baker, director of Creswell Crags, said that interest in the discovery 'exceeded all expectations'. He said: "On the day the news was released our team were busy fielding phone enquiries and calls from around the world.

"The day was regularly interspersed by cries of astonishment as we were contacted by major international broadcasters and publishers or discovered coverage from the furthest points around the globe. The story has been reported on every continent and has been translated into many languages. We are still reeling with excitement."

SOURCE: *Derbyshire Times,* 29 September 2019.

New visitor attraction in Charlestown, Cornwall

For the first time in more than a century visitors to Charlestown in Cornwall will have the chance to explore a network of tunnels beneath the Shipwreck Centre.

The new tourist attraction was opened to the public on 19 October in time for Halloween celebrations. In December they will be the setting for a Santa's Grotto with a difference.

Loading clay at Charlestown harbour

The newly-revealed section of tunnels means the public will have full access to the subterranean passageways which were created as part of St Austell's china clay industry in the early 1900s. There are 100 metres of tunnels which go in various directions. Visitors will be able to follow the original cart tracks, touch the walls where the historic white china clay dust still remains and look up to see the metal chutes which would provide a channel to transfer the prized product.

Charlestown was a vital port in Victorian Britain and, with the decline of St Austell's copper mines during the initial years of the 20th century, the clay and stone business became its main industry from 1906 onwards. On 19 September 1907, the *Royal Cornwall Gazette* reported that a clay dry was to be erected where the Shipwreck Centre now stands, and that clay slurry would be piped from Carclaze to Charlestown where it would be transformed into a saleable product.

The building which now houses the Shipwreck Centre, the Lovering clay dry and the tunnels were all constructed at the same time and those exploring the passageways will be able to imagine what it was like to work in the tunnels which remained operational until 1968.

Originally built to transport clay between the Lovering clay dry and the boats waiting in Charlestown Harbour, the tunnels had fallen out of use due to improvements in road and rail infrastructure as well as the slow demise of St Austell's china clay industry. Charlestown was built as an artificial harbour and is the only working Georgian harbour in the country.

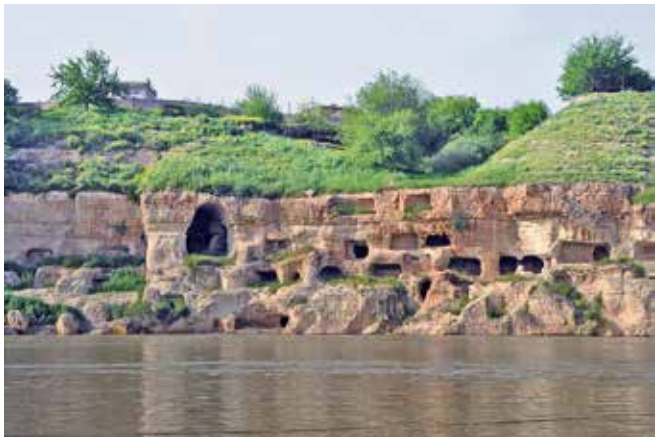
SOURCE: *Cornwall Live,* 16 October 2019.

Turkey starts to drown town with hundreds of cave dwellings

Turkish officials have begun the process of flooding a 12,000-year-old town to make way for a dam project to power the region. Hasankeyf, possibly one of the oldest sites of human settlement, will start to become an artificial lake as water journeys down the Tigris river.

Authorities on the Ilisu hydroelectric dam project have started to fill the dam with water, at another stage of the river, 50 miles away. The town is in the southeast of the country in an area often referred to as Turkish Kurdistan due to the large Kurdish population.

It once housed a 12th-century bridge, a 15th-century pillar tomb, two dilapidated mosques and hundreds of natural mountain caves and was home to thousands of residents. The caves in the ancient city have survived as homes since the Neolithic era with some locals still using them as dwellings today. Marks have been left on the town by all civilisations that ruled the region, including the Mesopotamians, Romans and Ottomans.



Cave dwellings at New Hasankeyf

Most of the artefacts, including a tomb, were moved during the summer to a location called New Hasankeyf and the townspeople were expected to follow by mid-October, leaving residents just over a month to relocate before the flooding starts. The dam and accompanying power plant will be capable of producing the same amount of electricity as a small nuclear plant.

SOURCE: *Mail online,* 23 September 2019.

Queensbury tunnel 'at risk', Yorkshire

The Victorian Society has added its weight to the campaign to save the 1.4-mile Queensbury railway tunnel on the former line between Keighley and Halifax from being irrevocably blocked and abandoned. It was opened to traffic by the Great Northern Railway in 1878, and closed in the 1950s.

Campaigners want to see the tunnel retained in use on a cycling route between Bradford and Halifax. Highways England seeks permanent closure by blocking entrances and shafts with concrete.

SOURCE: BROWN, Mark, 2019, Alarm over plan to let crumbling heritage disappear. *The Guardian*, 13 September 2019, page 28.

Tang Dynasty tomb found in a school sports field in China

Pristine wall art and delicate pots have been found inside a stunning thousand-year-old imperial tomb unearthed by Chinese builders at a school sports field. The underground chamber, believed to be one of several rooms, was

located underneath Xiaojingyu Elementary School in the city of Taiyuan. The school field was undergoing renovations, with workers sinking new foundations when they unintentionally punched through the ceiling of the burial chambers.

They are believed to date back to the Tang Dynasty, one of the greatest empires in the medieval world that ruled from 618 to 907 AD. Officials said the perfectly preserved murals and pottery appeared to be from the middle of the Tang Dynasty.

A tombstone inside the burial chamber suggested the individual laid to rest underground was "not a commoner". The Tang era is seen by many historians as an era of progress as well as the greatest period for Chinese poetry. Construction work at Xiaojingyu Elementary School, which is in Taiyuan's Wanbailin District, has been halted since the discovery.

SOURCE: *Mail online,* 21 August 2019.

Spectacular 'Tomb of the Kings' in Jerusalem opened to the public

Jerusalem's "Tomb of the Kings" – the burial site of Queen Helena of Adiabene, a Jewish convert – has been opened to the public for the first time in a decade. Paying visitors to the French-owned archaeology-cum-holy site in the city's eastern sector can see the tomb's impressive courtyard which dates back over 2,000 years.

France, which has managed the site since the late 19th century, had closed off access as part of an extensive restoration costing £900,000 in 2009. The readmittance of limited numbers of visitors follows several aborted attempts by the French Consulate General to reopen the tomb earlier in the year.

Access to the interior burial chambers will remain prohibited, but the public can purchase tickets to visit the tomb's courtyard and entrance. Despite the reopening, tensions remain between French authorities and both Israeli nationalists and ultra-Orthodox Jews who contest the site's ownership and entry fee.

The Tomb of the Kings is 'definitely one of the most elaborately decorated tombs from the early Roman period' in Jerusalem. The underground burial complex – which dates back to the first century BC – remained in the

public consciousness and was a popular tourist attraction. It featured in the writings of the Roman-Jewish historian Titus Flavius Josephus around 200 years later, and in the second century AD was dubbed the 'second most beautiful tomb in the world' by the Greek geographer Pausanias.

The site features a lowered courtyard hewn into the rock, channels that ran water into a ritual bath, and a burial stone operated by a sophisticated mechanism. Entrance to the multi-level burial chambers comes via an ornate entryway that was once supported by two giant pillars, fragments of which were recovered in the 19th century.

SOURCE: *Mail online,* 8 November 2019.

MILITARY AND DEFENCE

Return to the Cold War in Sweden?

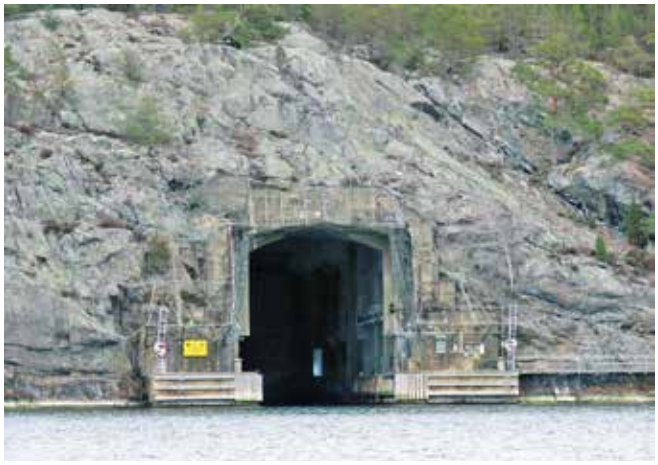
Sweden's navy HQ is returning to a vast underground Cold War fortress designed to withstand a nuclear attack, in what has been seen as a defensive move against a resurgent Russia. After a 25-year absence, the navy will once again be commanded from beneath billions of tonnes of granite as the country strives to build up its defences in response to the perceived threat from Moscow. Completed in 1969, the underground complex boasts cavernous underground docks that can shelter warships, with miles of tunnels, offices and a hospital.

On its return to Muskö on Monday, the Swedish naval command said the new location would offer greater freedom of manoeuvre. The move is based on the calculation that the Russians could use powerful weapons which demand the level of protection that only Muskö can provide.

Sweden's army and air force commands are also moving out of the capital and into more fortified locations, spreading their headquarters geographically to make them less vulnerable to attack. But the navy's relocation is the most dramatic, and emblematic of a revival of Cold War sentiment in the country.

Like most European nations, Sweden cut its military spending sharply after the Cold War ended, from about 2.5% of GDP in 1990 to barely 1% by 2010; equipment was scrapped and bases were closed. The shipyard on Muskö was sold off to German engineering company Thyssen Krupp. But the occupation and annexation of Crimea by Russia in 2014 changed things completely, showing that this is what Russia does to its smaller neighbours.

Swedish defence company Saab bought out Thyssen Krupp in June 2014, after some arm-twisting that involved mass recruitment of Krupp's staff and a dawn raid by the defence ministry on Krupp's shipyards in Malmö, ostensibly to rescue military secrets. Other recent moves to strengthen Sweden's military preparedness include bringing back conscription, and a leaflet delivered to every household explaining what to do in case of a nuclear attack.



Though Muskö ceased to play a central role in Swedish defence in the 1990s, the navy never left the island entirely. When British and Belgian enthusiasts tried to infiltrate the base late last year, they were met with warning shots before being arrested.

It will take several years for the base to be comprehensively modernised and renovated. According to the military officers' trade union, the underground command centre will not be fully equipped until 2021 or 2022.

SOURCE: *Navy Recognition,* 4 October 2019.

WWII Australian Air Force bunker for sale

In 1941, the Royal Australian Air Force (RAAF) built a bunker into the side of a hill to hide it from the Japanese. It was used to store fuel for the Mildura base which is nearby on the Murray River in Victoria. Now the WWII bunker in Yelta with its 8mm steel walls encased in reinforced concrete is listed for sale as a four-bedroom home in an upcoming real estate auction. The price guide for the property is A$260,000 to $280,000.

Thirty years ago, Stephen Gooding purchased four bunkers on a four-hectare property and transformed them into homes for himself and his family. Gooding currently lives with his wife in a bunker that he converted into a six-bedroom home. He sold two of the others and has now put the fourth bunker up for sale.

The unique home sits on 5,000 square metres of land which the new owner can do with as they like. Each room in the bunker has its own ceiling fan. The kitchen contains a gas oven and range and a dishwasher. The living area is open throughout the kitchen, dining room, and living room. There are also two bathrooms. The temperature in the home stays around 20 degree Celsius so heating and cooling bills are low. One of the selling points for the property is the extreme privacy. According to Gooding,

you cannot hear your neighbours. The property was sold at auction on November 16.

The bunker was part of the Mildura No. 29 Inland Aircraft Fuel Depot and used by the RAAF from 1942 to 1947. No. 29 IAFD was part of 31 Inland Aircraft Fuel Depots that were built by 1944. Each bunker was staffed with a five-man crew consisting of a cook, an equipment assistant and three guards.

The bunkers were established after Japan's attack on Pearl Harbor made a potential invasion of Australia much more likely. As a result of the military's actions to defend the country, six-month fuel usage estimates rose from 3.2 million gallons at the beginning of December 1941 to 15 million gallons by the end of the year.

The January estimates rose to 40 million gallons for the RAAF and another 10 million gallons for the US Army Air Corps units dispatched to Australia. The ability of the RAAF to defend against a Japanese invasion was increasingly tied to the availability of fuel. This was the necessity that led to building the 31 fuel depots and to increasing the capacity of the tanks in the depots that had already been built.

After the war, No. 29 IAFD was sold to the NSW Water Commission who used it to store oil. They were sold to private buyers around 1992.

SOURCE: *War History Online.*

Hope Cove RGHQ and ROTOR bunker on the market again

At the time of the emergency listing of the ROTOR R6 and former RGHQ at Hope Cove the owner, a consortium, was in the process of trying to convert the bunker into a wine store for which they had begun an interior strip out

Photo Nick Catford

ready to cut a 12 foot square hole in the eastern face of the bunker at ground level. This work was ongoing when the bunker was listed, and all works ceased immediately.

The bunker was quickly put on the market again with sealed bids needing to be lodged with the estate agents by the last day of November 2019.

On one of the viewing days Sub Brit member Chris Howells noted that considerable damage had been done to the bunker which had been left in a poor state by the owner. John Smiles has put together a small group of people who will be spending some time at the bunker, probably in May 2020, to clear up some of the mess.

SOURCE: Saving Wartling ZUN Facebook Group

Site of RGHQ 2.2 in Hexham to become Lidl store and Travelodge

Northumberland County Council has welcomed a £20million Hexham development featuring a hotel, supermarket and extra parking for the town. The local authority's strategic planning committee unanimously approved a hybrid application for the town's bunker site, off Alemouth Road, at its meeting on 5 November.

RGHQ 2.2, Photo Richard Lamont

The plot is known as the Bunker site due to a large cold store that formerly occupied it, which was converted by the Government into a nuclear bunker in the early 1980s and became RGHQ 2.2. The bunker was bought in December 1996 by local builders' merchant Matthew Charlton & Sons, who intend to redevelop the site, and it was subsequently demolished.

Full planning permission was granted for a 2,177m² Lidl food store plus customer parking, a four-storey, 69-bedroom Travelodge hotel and 250 public parking spaces, alongside outline permission for a further two retail units, totalling 1,600m².

SOURCE: *Northumberland Gazette,* 6 November 2019.

US in race with USSR to build a military base on the moon during the Cold War

During the Cold War, the U.S. government was hell-bent on one upping the commies in any way possible. In the process, they came up with a number of outlandish plans, such as that time they proposed nuking the moon, interestingly enough a project a young Carl Sagan worked on. There were also many more down to Earth projects like the development of what would become the internet in order to ensure ease of sharing information among the nation's scientists. This brings us to a project that unfortunately went into history's dustbin- the U.S. Army's plan to build a massive military installation on the moon.

Known as Project Horizon, the impetus for the plan came when the Soviets set their sights on the moon. As noted in the Project Horizon report, "The Soviet Union in propaganda broadcasts has announced the 50th anniversary of the present government (1967) will be celebrated by Soviet citizens on the moon."

U.S. National Space policy intelligence thought this was a little optimistic, but still felt that the Soviets could probably do it by 1968. Military brass deemed this a potential disaster for the United States for several reasons.

To begin with, if the Soviets got to the moon first, they could potentially build their own military base there which they could use for a variety of secret projects safely away from the United States' prying eyes. In the extreme, they could potentially launch nuclear attacks on the U.S. with impunity from that base. Naturally, a military installation completely out of reach of your enemies both terrified and tantalized military officials.

Next up, if the Soviets landed on the moon first, they could try to claim the entire moon for themselves. If they did that, any move by the U.S. to reach the moon could potentially be considered an aggressive act, effectively making the moon off limits to the United States unless willing to risk war back home.

This was deemed to be a potential disaster as the moon, with its low gravity, was seen as a needed hub for launching deep space missions, as well as a better position to map and observe space from than Earth.

Beyond the practical, this would also see the Soviets not just claiming the international prestige of an accomplishment like landing and building a facility on the moon, but also countless other discoveries and advancements after, as they used the moon for scientific discovery and to more easily launch missions beyond.

Of course, the Soviets might do none of these things and allow the U.S. to use the moon as they pleased. But this wasn't a guarantee. As noted in the Project Horizon report, "Clearly the US would not be in a position to exercise an option between peaceful and military applications unless we are first. In short, the establishment of the initial lunar outpost is the first definitive step in exercising our options."

The threat of having the moon be in Soviet hands simply would not stand. As President Lyndon B. Johnson would famously state in 1964, "I do not believe that this generation of Americans is willing to resign itself to going to bed each night by the light of a Communist moon."

Thus, long before Kennedy would make his famous May 25, 1961 declaration before Congress that the U.S. "should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth", military brass in the U.S. were dead-set on not just man stepping foot on the moon, but building a military installation there and sticking around permanently.

SOURCE: *Today I Found Out* 30 May 2019.

Renovation of the ROTOR R11 operations block at Snaefell, Isle of Man

The work continues to stabilise and improve the main ROTOR Operations Block on Snaefell mountain. The tatty mural is being removed and causing some debate locally. New modern window units have also been installed in recent weeks. The Standby Set House is destined to become a brewery at some point.

SOURCE: Chris Corkish.

Photo Chris Corkish

The Paddock Information Collection 2019 edition

A new edition of *The Paddock Information Collection* is now available online. Paddock was the designated standby protected underground Cabinet War Room in World War II and is located in Dollis Hill in north London in what were once the grounds of the Post Office Research Station.

Generator room. Photo Nick Catford

The Collection brings together documents, images and other publications about Paddock into a single place and has been painstakingly compiled by Sub Brit member Bill Ridgeway. The information Collection includes more general information on the Post Office Research Station, details of the construction of the bunker and what has happened since.

The timeline starts in 1914 and continues to the present day. A detailed tour of the site is included as are over 300 images. The Collection is recommended – especially to those who have a special interest in this fascinating site.

The Paddock Information Collection may be downloaded from www.bunkers.org.uk.

Get wed in a bunker at Holmpton, Yorkshire

Bunker Weddings is a new venture launched by Gina Wright. Located at the former RAF Holmpton R3 ROTOR bunker in Holderness built between 1952 and 1954, the business was launched in August and offers couples the chance to hire the underground two-level bunker, with its maze of tunnels and rooms, for a period of three to four hours.

PDU Room

The bunker, located south of Withernsea, provides an eye-catching – if not unconventional – backdrop for a couple's big day. By day, the bunker now operates as a museum, after the Ministry of Defence sold it in 2014. For more information on the bunker, and East Yorkshire's new wedding venue, visit www.bunkerweddings.co.uk/.

SOURCE: *Hull Live,* 14 September 2019.

Fort Gilkicker for sale as a housing development, Hampshire

The Grade II listed Fort Gilkicker and its sea-facing arched gun ports could be transformed into luxurious town houses after plans were given the go-ahead by developers. The bill to convert the 19th-century fort at Gosport, near Portsmouth into extravagant homes could be as much as £18m.

The Palmerston fort, constructed between 1863 and 1871, was set to be converted into 26 luxury coastal properties before previous developers pulled out of the multi-million

pound project almost a year ago. In 2017 plans were on display for the fort to be developed into 22 townhouses and four luxury flats. Potential buyers were told they'd be able to get their hands on the exclusive properties from a starting price of around £1.2million.

Now Fort Gilkicker, which offers spectacular panoramic views towards the Isle of Wight, is back up for sale but buyers are being warned of the high price tag. Fort Gilkicker was built to cope with growing threats of invasion and to guard the nearby Portsmouth Harbour and waters. It was built under Prime Minister Lord Palmerston to defend the deep water anchorage at Spithead, with 22 guns in casemates and five heavier guns in open positions on the roof.

Artist's impression of the housing development at Fort Gilkicker

The fort was armed during both World Wars and a signal unit occupied the fort in the lead up to D-Day. When the Government abolished its coastal defence programme in 1956, the fort was used by the Ministry of Public Buildings and Works as a plumbers' workshop.

Hampshire County Council bought the fort in November 1986 and it was used as a building materials store, before being considered for housing.

SOURCE: *MailOnline,* 20 November 2019.

NEWS: MISCELLANEOUS

Archaeological excavation of an anti-nuclear protest campsite, Lower Saxony, Germany

In 1977 the then West German government planned to construct a nuclear reprocessing and storage facility near the village of Gorleben in Lower Saxony. The storage provision was to have been created at some depth in massive rock salt, and preparations were set in train for test drilling into the rock salt below the site.

There was strong local opposition, and site investigations remain incomplete. In May 1980 a large (one hectare) protest camp with over 120 wooden huts and a population of up to 800 persons was created. The camp was demolished by the police authorities after 33 days, and its ruins buried under a depth of 0.6 metres of bull-dozed material. During 2017 and 2018 the campsite, located by reference to aerial photographs, was excavated revealing the footprints of more than 60 of the huts and associated material in the form of some of the inhabitants' possessions.

Some of over 1,000 objects found have been interpreted as discarded by the 8,000 policemen who evicted the campers. The memories of local residents and objectors have been correlated with the excavated remains. The present German government is currently reconsidering completion of the geological investigation and use of the site for its originally intended purpose.

SOURCE: DÉSZI, Attila, 2019, Historical and community archaeology at an anti-nuclear protest camp site. *Newsletter: Society for Post-Medieval Archaeology,* 85, 5–6.

World's first underground nuclear waste dump is being built beneath a remote Finnish island

The Onkalo tunnel will be the final resting place for spent nuclear fuel 450 feet beneath the surface of Olkiluoto island, 143 miles northwest of Helsinki.

The tunnel has been designed to survive without future maintenance for an astonishing 100,000 years. The engineers behind the project say they are relying on the bedrock – which has been stable for billions of years – to protect the fuel from future man-made and natural catastrophes.

The International Atomic Energy Agency estimates that there is now a global stockpile of around a quarter of a million tonnes of highly radioactive spent fuel in some 14 countries. A Greenpeace report warned: "The majority of this spent fuel remains in cooling pools at reactor sites that lack defence-in-depth such as secondary containment and are vulnerable to loss of cooling, and in many cases lack independent back-up power."

Sweden has similar plans to store nuclear waste deep underground but the project was postponed after an environmental court put its safety in question last year.

Other countries, including the US, have plans to reduce the physical volume of their mounting nuclear waste but a decades-old US project to bury waste deep within Nevada's Yucca Mountain has been stopped by local opposition.

The Onkalo tunnel's operator Posiva said the final disposal facility will consist of two sections: the above ground encapsulation plant where nuclear fuel will be received, dried and packed into final disposal canisters, and the repository located deep inside the bedrock, in which the most important sectors are the tunnels where the fuel is disposed of.

The final disposal is scheduled to start in the 2020s and according to current plans, the repository would be sealed up 100 years from then.

SOURCE: *Daily Express,* 31 October 2019.

Former underground rifle range in Norwich for sale

An extensive lower ground floor/cellar area formerly used by Eaton Rifle Club with approximately 2,455 sq ft (228.1 sq m) of space has been offered for sale in Norwich. It is opposite The Bell Jar shop and a coffee shop called Ninety One. Go through the gates, walk to the back of the parking area and the entrance is on the back right.

The entrance is accessed on ground floor level (with WC facilities) with steps down to the main area comprised of three principal areas, all of varying height (main section 2.7m) and with store rooms. The main cellar area has an uninterrupted length of approximately 27 metres.

The property is located on Upper St Giles Street, Norwich, in the heart of the City and accessed via a pathway to the side of a block of flats on the south side of the street. Upper St Giles is a quiet but vibrant location with art galleries, coffee shops and restaurants making it a desirable location.

SOURCE: *Rightmove* website.

Inside the Welsh Government's secret 'no-deal Brexit' bunker

Tucked away within the bowels of the Welsh Government's offices in Cathays in central Cardiff is a room like no other in the building, maybe no other in the country. Most people would pass it without a second's thought. Down a set of stairs and through a pair of wooden double doors is the 'situation room' – an area that is now getting ready for the potential fall-out of a no-deal Brexit.

The Welsh Government is keen to show its readiness. For months, Welsh ministers have issued statement after statement warning of the implications of a disorderly departure from the EU. But the message is always counter-balanced with one of how the executive in Wales is taking steps to prepare for the worst.

In the centre of the room, there is a table-top map of Wales. Reminiscent of the Battle of Britain, it's the type you might imagine to have in a war film, with top generals moving around small model tanks to mimic troop formations.

The bunker is split into three different rooms: Communications, Partner Agencies and the cabinet room. It can handle 200 people when fully staffed and can run on a 24/7 basis. There are desks everywhere. All have

Situation room

computers on top with phones next to them. Flat-screen televisions are fixed to almost every wall.

The Partner Agencies room is the largest space. Dotted around the room are signs on the walls indicating where the police, military, public health and others will be stationed. The bunker was due to jump into action two weeks before the planned Brexit day of 31 October, with long shifts early in the morning until late at night.

A week before Brexit it was planned that the bunker would mobilise on a 24-hour basis, with three shifts, seven days a week. Brexit day came and went and now, as country and Westminster wrestles with what to do about Brexit, the bunker is asleep but ready to spring into life if required.

SOURCE: *LBC News,* 16 September 2019.

New use sought for disused Stockholm railway line and tunnel

An old overgrown railway line and a tunnel with an intriguing history hide close to one of Stockholm's most popular bathhouses. The track was laid between 1925 and 1940 and stretches from the top northeastern tip of the Södermalm near the harbour and arcs to the southwest. It was built to transport wounded men arriving by ship to the harbour who would then be transported to an underground disaster centre hidden beneath the hospital.

But no ships full of wounded World War II soldiers ever arrived. The railway did see some violence, though, as it was one of the places bombed by the Soviets during the February bombings of 1944.

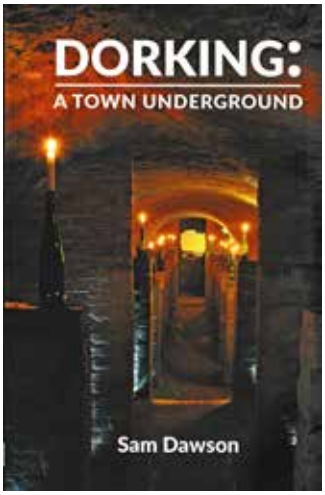
The city has made several requests to remove the railway tracks to construct houses in their place. The request keeps being turned down, leaving the city to find other uses for the

space. Marathons have been held there, as well as theater shows and art exhibits. Proposed plans for the tunnel include a pedestrian path, concert hall, and even a ski trail.
SOURCE: *Atlas Obscura.*

PUBLICATIONS

Dorking underground

DETAILS: DAWSON, Sam, 2019, *Dorking: a town underground.* Dorking Museum and Heritage Centre: 168pp [ISBN 978-1-909871-14- 4]



Dorking is a small town in east Surrey, a few miles west of the larger Reigate / Redhill. Both town centres are built on the Folkestone Sand beds, the highest of the Lower Greensand, and both have a wealth of rock-cut underground spaces, rivaling the City of Nottingham and its 'caves' although at both places these are not technically natural caves at all.

However, although nominally having the same geological context, the man-made underground spaces of the Dorking and Reigate districts are significantly different, with relatively large scale subterranean mining for minerals at and near the latter place, but not at Dorking.

Dawson's new book is largely devoted to illustrated descriptions and interpretations of the cellars and crypts under churches and cellars and commercial establishments in the town centre, with, also, sites in the neighbourhood including Box Hill, the Mole Valley, and Brockham and Betchworth villages nearby.

Pride of place is given to the enigmatic South Street caves, where public guided tours are operated by Dorking Museum volunteers. These are an apparently purposeless 17th and 18th century folly, the upper part of which has been used for wine storage. The network of short tunnels and flights of steps intercepts three vertical shafts, possibly sunk as wells, and descends about sixty feet to a small circular chamber with a peripheral circular rock-cut bench. What has been found relating to this site by diligent searching of local records, accompanied by the interpretation of observable archaeological features is presented. Parallel follies at Eastry in east Kent and at Williamson's tunnels at Edge Hill in Liverpool come to mind.

The less familiar burrowings of Charles Howard at Deepdene, and what remains to be seen of the gardens, are described. Howard's underground landscape included 'laboratories' although what they were used for is apparently not recorded – possibly alchemical experiments in attempts to transmute base metals into gold. The impressive but now demolished mansion at Deepdene housed a railway control centre during World War II, when additional bomb-proof tunnels were made. Sadly these have suffered grievous damage by 'urban explorers' breaking and entering and vandalizing the interior. Nearby Betchworth Castle, deliberately dilapidated by a previous owner to create a 'romantic ruin' is next described. It is publicly accessible and has partially unroofed cellars. There is a surviving 1890s mobilisation centre on National Land at Boxhill, now a winter hibernation site for bats. A splendidly restored similar structure at the top of Reigate Hill, also National Trust, is open access, with guided tours of the underground casemates and ammunition stores by arrangement. Elsewhere in and around the Mole Gap there can be found by diligent searching reminders of World War II such as anti-tank obstacles emplaced when German invasion seemed a distinct possibility.

Back in the town centre there were no deep tunneled air-raid shelters, neither the town council nor the Surrey County Council choosing to finance them. Instead numerous cellars, some at least of them strengthened, and surface shelters, were deemed to be sufficient protection from bombing.

Sam Dawson has evidently been successful in gaining permission to enter and photograph many of the cellars under public houses and commercial premises and church crypts, and has reported on archaeologically significant surviving features.

The scope of the book extends to mineral resources worked opencast, especially chalk at the former Dorking limeworks, and similar but better preserved features such as lime kilns at nearby Brockham and Betchworth. The latter places had actively worked hearthstone mines into the 20th century, although all that can now be seen is a mine shaft at Brockham. The only other mine in the Dorking area is an underground mine or quarry for chalk at Westhumble in Mickleham parish, north of Dorking. Also underground, but never likely to be accessible, is the subterranean route of the river Mole in times of drought. The river disappears down swallow-holes at Mickleham, and rises again at springs at Leatherhead. The word Mole, however, is thought to derive from a mill, or mills, not from the underground water flow.

Arguably, the biggest and longest tunnel in the district is not mentioned. The Betchworth railway tunnel (over 500 yards long) was driven in the 1860s on the line southwards to Horsham, but fell in later in the 19th century, and was subsequently cleared and is still in use. Also perhaps worth a mention is the 'tunnel that never was'. George Samuel Measom was the author of 'official' guides to

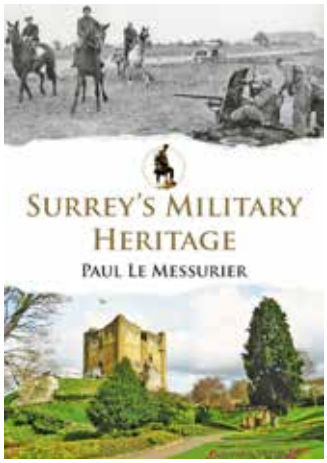
the lines of a number of Victorian railway companies. In his 1853 guide to the South Eastern Railway (Reigate to Guildford via Dorking) he informs readers that between Betchworth and Dorking Deepdene the train passes in tunnel below Boxhill. Passengers, instead of plunging into darkness, have a splendid view of the southern slopes of this well-known beauty spot. Measom evidently had in mind Brunel's famous Box Hill tunnel on the Great Western Railway between Chippenham and Bath. As the same error is repeated in the 1861 edition, it seems the directors of the South Eastern Railway did not check this 'official' guide to their line for accuracy!

This is an impressively researched book with a wealth of hitherto not readily accessible information supplying the economic, political and social context in which the underground sites are considered, and highly recommended.

San Dawson, a Subterranea Britannica member, and the Dorking Museum are to be congratulated on publishing this book and arranging guided tours of the South Street 'caves'.

Surrey's military heritage

DETAILS: LE MESSURIER, Paul, 2019, *Surrey's military heritage.* Stroud: Amberley Publishing: 96pp [ISBN 9781-4456-8962-3]



For the purposes of this volume, sites mostly in the current administrative county of Surrey are reviewed, although a few in former historic Surrey, which extended right up to the Thames, are also included. The scope ranges from Roman military roads through Norman castles and scant evidences for the English Civil War through to the nineteenth century and the two World Wars.

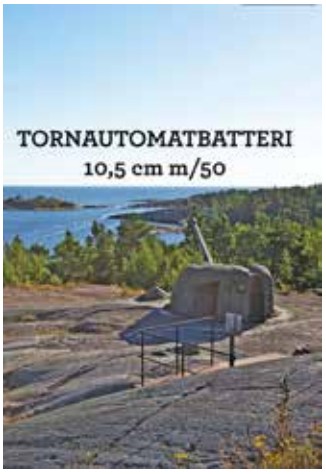
Surface sites are illustrated, and the text consists of a potted history of invasion risks, relics of actual invasion by the Romans and the Normans, internal battles, and the two World Wars. There is no mention of the Cold War, a glaring omission!

A number of the locations featured have publicly accessible underground components, although these are largely ignored. There is a photograph of the upper entrance to the so-called 'Barons' Cave' at Reigate Castle (possibly an unusual style of wine cellar) but not a photograph of the impressive interior. And the much more modern, probably largely 18th- and 19th-century 'caves' (originally silver sand mines), also under Reigate Castle, and equally publicly visitable, are not mentioned: they were used for military storage in World War I and as public air-raid shelters in World War II.

Surface buildings of the late Victorian 'forts' (mobilisation centres and stores) at Box Hill and Reigate Hill are featured, but their subterranean ammunition stores are not mentioned, although the latter can be visited on National Trust guided tours. Finally, the Surrey County Council's five deep-tunnelled 1940s air-raid shelters are not mentioned, although the tunnel entrances to one of the two at Epsom and the one at Kenley (now in the London Borough of Croydon) can be seen from public roads.

Tornautomatbatteri 10,5 cm m/50, Stockholm archipelago

DETAILS: HANSSON Lars and LAUSEVIC Vladan – **Swedish Cold War Coastal defence**



Over fifty years after the first military exercise with the battery and more than ten years after it became a museum, there's a new book describing battery Arholma and the two other 10.5 cm m/50 batteries established as part of Sweden's Cold War Coastal Artillery system. The book explains why Arholma was originally chosen as the site for a Coastal battery in the 1940s. It discusses what it was like to be an officer at the front line facing 'the enemy' for over fifty years during the Cold War.

Sub Brit member Lars A. Hansson and Vladan Lausevic have studied archives and talked to people; with a number of chapter-writers they have summed up the military history of Arholma, the story of the battery and gun type, the bedrock facilities and how a top-secret site eventually became a museum.

The book contains 116 pages in A4 format and has a complete English translation that is merged into the Swedish text and pictures. There are 274 images including 11 scans from newspapers and governmental press releases and 31 drawings of the three batteries.

See also https://en.wikipedia.org/wiki/Arholma. The book can be purchased through Fortress Books in Holland at www.fortress-books.com/ or via the author at www.bunkertours.se/

Industrial archaeology in Somerset

DETAILS: DANIELS, Peter, 2019, *A guide to the industrial archaeology of Somerset.* Association for Industrial Archaeology: 80pp [ISBN 9781-9161764-0-9]

The Association for Industrial Archaeology (AIA) holds its annual conference at various locations in the British Isles including, in 2019, residential accommodation at a Further Education college at Cannington, near Bridgwater.

Members attending are supplied with an up-to-date gazetteer of sites of interest in the area visited, this year's guide being to the present administrative County of Somerset, excluding therefore those areas lost in 1974 on the formation of the North Somerset and the Bath and North East Somerset Unitary Authorities. Copies of these valuable guide books are afterwards available for general sale.

Topographically, Somerset comprises upland areas such as Exmoor, the Quantock Hills, the Brendon Hills and the Mendips and, more centrally, the low-lying and occasionally flooded Somerset Levels. It is the higher ground formed on geologically older rocks that much of the underground industrial archaeology is to be found, represented mostly by mines for coal in the small Somerset coalfield, ironstone in the Bredon Hills, and also calamine (zinc ore) and ochre (iron oxide used as a pigment) in a few places.

The Levels are understandably lacking in underground sites, with flood alleviation and drainage works featuring prominently alongside minor rural industries. There are a few tunnels in the area's current and former canal and railway lines.

Military and defensive works hardly feature, the World War II Taunton Stop Line being most notable. If this guide is to be believed, Somerset was completely by-passed by Cold War planners!

Tilberthwaite copper mines and Penny Rigg Mill, Coniston. Cumbria

DETAILS: MIDDLETON, Penny, John PICKIN, and Kate CHAPMAN, 2017, Penny Rigg copper mill: archaeological community landscape and building survey. Northern Archaeological Associates Ltd: 86pp + appendices [Cumbria / Lake District / Coniston Copper Mines]

O'BRIEN, Helen, *et al*., 2018, The people of Coniston copper: life and death in a mining village. Northern Archaeological Associates Ltd: 32pp [Cumbria / Lake District / Coniston copper mines]

PICKIN, John, *et al*., 2018, Tilberthwaite copper mine, Coniston, Cumbria. Northern Archaeological Associates Ltd: 126pp + plates.

ROBINSON, Jeremy Rowan, and John PICKIN, 2018, Coniston copper mines and mill. The history and archaeology of Tilberthwaite mine, Cumbria. Northern Archaeological Associates :Ltd: 35pp [ISBN 9781-910794-15-9]

Tilberthwaite copper mine at national grid reference NY 30656 00695 and its associated ore dressing mill near Coniston in the Lake District National Park fall within the recently designated World Heritage Site.

The surface remains, but not the shafts, levels and underground workings, were surveyed, and related archival sources explored, during the years 2016–17, the work being commissioned by the Lake District National Park Authority. Two detailed archaeological reports incorporating plans of the area surveyed and a small-scale excavation have now been published, as have two illustrated popular booklets summarizing the archaeology and history of the mine and mill.

The mine is known to have been worked, and German expertise deployed, from the sixteenth century through to abandonment in 1930. Some subterranean slate quarrying was subsequently carried on from within the mine workings to 2000. In recent years underground exploration and restoration of limited access has been carried out, and is briefly mentioned.

TUNNELS AND TUNNELLING

Closure of pedestrian subways at East Croydon and Norwood Junction stations, south London

Network Rail proposes massive changes to the layout of lines northwards from East and West Croydon stations, and to the stations at East Croydon and Norwood Junction (South Norwood).

East Croydon is one of the busiest railway stations in the British Isles, serving direct trains to London (London Bridge, St Pancras International and Victoria), from the south coast (Southampton to Hastings), as well as suburban lines and inland towns in Kent, Surrey and Sussex. At both East and West Croydon stations there are trains to London Bridge and Victoria, as well as via St Pancras to Bedford, Cambridge and Peterborough.

There is an extensive complex of lines and junctions, the 'Selhurst Triangle', north of Croydon, and problems of line capacity and conflicting routes frequently delay trains here. There are also passenger access problems at Norwood Junction such as very narrow platforms and staircases down to a subway for exiting or changing platforms. There is no step-free access to platforms other than platform 1 immediately beyond the ticket gate line.

Norwood Junction subway

Current proposals, as part of the overall Croydon scheme to increase line capacity, include the radical re-engineering of the lines, junctions and grade separations in the Selhurst Triangle, and reconfiguring lines and platforms at East Croydon and Norwood Junction.

At East Croydon a second pedestrian footbridge and additional station entrance at the London end of the station have already been built, the bridge accommodating space for additional lines and platforms, with two additional lines (from six to eight platforms) at the west side of the station. Additionally the pedestrian subway linking all six current platforms has been closed, blocked off if not actually filled in. The consequence of this is that passengers needing to change, say, between the present platforms 1 and 3 (for northbound services) have to walk to the far ends of those platforms, beyond the platform canopies so (at the north end) exposed to the weather. All the platforms are now so long to accommodate twelve-coach trains,

Norwood Junction has never been the most convenient station, with no step-free access to most platforms, and extraordinarily narrow platforms and stairways down to the pedestrian subway. These features are particularly problematic when large numbers of passengers are visiting the nearby Crystal Palace Football Club's ground (which is at Selhurst, not at Crystal Palace). Here as at East Croydon it is intended to close the weather-proof pedestrian subway midway along the platforms, and replace it with new pedestrian bridges at the north and south ends. The reasoning appears to be that subways are generally disliked by the public.

At East Croydon a positive feature is the provision of lifts for access to the new overbridge as an alternative to the flights of steps. The same provision at the south end of the station for the main entrance and booking hall would also be welcome, or escalators, as at present there are only long ramps.

At Norwood Junction, two Up Slow lines would serve either side of a widened and lengthened island Platform 2/3 (renumbered 1/2), the 4/5 island platform would be demolished and the Up and Down Fast lines diverted through the site, and two Down Slow lines would serve either side of a lengthened and widened island Platform 6/7 (renumbered 3/4). This would enable all changing between trains (ie trains in the same direction) to be done cross platform.

Two new footbridges would be provided at the north and south ends, the latter with lifts. The passenger subway would be closed. Platform 1 would cease to be used for boarding / alighting from trains, but would remain as the passenger route between the west side main entrance and the footbridges. The result of this would be a lengthy and circuitous walk by way of one end or the other of the long platforms for access to any train.

SOURCE: NETWORK RAIL, 2019, Norwood Junction rebuilding. *London Railway Record* 98, pages 101 and 198, and 319.

New tunnel between Ebbsfleet and Bluewater planned

A planning application for a new £12 million tunnel linking Ebbsfleet Garden City to Bluewater shopping centre has been submitted to the council. The proposal from Kent County Council for a Fastrack bus service, which would connect major developments in Dartford, has been sent to the local authority.

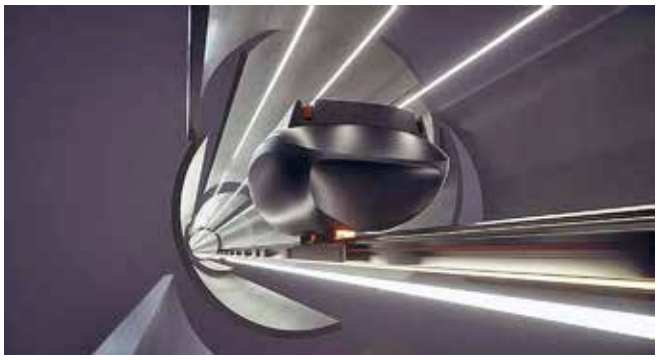
One of the existing Bluewater construction tunnels. These will not be used

Two haulage tunnels which were used during the construction of Bluewater in the 1990s were considered for this service, but an investigation into their potential found it would be more cost-effective to build a new tunnel. No objections were raised by the Environment Agency, who were consulted by Kent County Council

SOURCE: *Kent Online,* 20 November 2019.

Network of tunnels for distributing parcels proposed for London

A British-owned transport company is proposing to install a network of underground tunnels that could deliver more than 600 million packages a year in London alone. Magway, based in Wembley, London, was founded in 2017 by Rupert Cruise, an engineer that worked on Elon Musk's Hyperloop project, and Phil Davies, a business expert.



Artist's impression of the Magway tunnel

A series of tunnels would transport 72,000 carriages per hour each holding four parcels along a magnetic track, which propels them forward at just under 40mph when activated by an electric charge. This would give retailers a quick and cheap way to move goods between distribution and fulfilment centres, and could be up and running in as little as three years.

The company has so far raised £1.5m through investors including British supermarket Ocado – who may use the service in the future – and a government Innovate UK grant of £650,000. They are also in talks with Heathrow in the hopes a series of tunnels could carry baggage and duty-free goods to terminals - which would act as a trial run for the Magway system. However estimates for building the tunnels and carriages to carry the packages alone will cost a massive £1.5m per mile – with an extra £3.5m needed to get planning and legalities secured.

SOURCE: *Mail Online,* 15 November 2019.

Scotland's finest and best preserved tunnel, Paisley, near Glasgow

The fourteenth-century Abbey Drain under the town centre of Paisley, first rediscovered in the nineteenth century, has been re-excavated, revealing a well-preserved stone archway at its outfall at the River Cart.

It is described as "Scotland's finest and best preserved medieval tunnel".

SOURCE: ANON, 2019, Light at the end of the tunnel in Paisley. *Current Archaeology* 307 (355).

Bakerloo line extension proposals

Transport for London has invited the public to give their views on the most detailed proposals yet for an extension of the Bakerloo line. The latest consultation follows feedback given in previous public consultations in 2014, which focused on a comprehensive analysis of the route options, and in 2017 which highlighted potential station and shaft locations.

An extension to Camberwell was due to be built in the late 1940s. The route was shown as 'under construction' on maps and some signage, like this illuminated sign at Maida Vale, was installed in ancipitation. Photo Nick Catford

The extension, proposed to run from Elephant & Castle to Lewisham via Old Kent Road and New Cross Gate, is vital to improving public transport capacity for southeast London by providing a high frequency Tube service directly into central London.

It will help meet the needs of the capital's growing population, which is forecast to increase by more than ten million people by 2030, and will help deliver more than 5,000 new jobs and at least 25,000 new homes when built.

TfL is now seeking views, as part of a 10-week consultation, on the following proposals:

- A new integrated station entrance at Elephant & Castle which would see the ticket halls for the Bakerloo and Northern lines combined. It would be built as part of the planned upgrade of the Northern line ticket hall, and delivered as part of the proposed new shopping centre development;
- The route of the proposed tunnels from Lambeth North to Elephant & Castle, and Elephant & Castle to Lewisham. Now that TfL has decided on the preferred location of the proposed stations and shafts, there is a better understanding of the alignment of the tunnels. TfL's tunnel route proposals, which include a shorter, quicker route between Lambeth North and Elephant & Castle, are included in this consultation for the first time;
- The location of the primary and secondary tunnelling work sites. Having considered a number of options, TfL's preferred primary work site is at New Cross Gate. TfL is also proposing a new secondary work site as part of the 'Old Kent Road 1' station site;
- A possible further extension of the route beyond Lewisham to Hayes and Beckenham Junction in Bromley, involving the conversion of a Network Rail line.

In addition, TfL is asking people for their views on names for the two proposed new Bakerloo line stations on the Old Kent Road. The consultation will close on Sunday 22 December 2019.

SOURCE: *News Shopper.*

The Gerede water supply tunnel for Ankara, Turkey

Work commenced in 2012 on a 31.58 kilometre tunnel to transfer water from the Ulusu river in northwestern Turkey southeastwards under the Isikli mountain to the capital. Water is intended to flow gravitationally from the upper end of the 4.5 metre diameter concrete lined tunnel 1,142 metres above sea level to an outfall at 995 metres asl.

At the deepest point the tunnel runs 600 metres below the surface. The geology is challenging, including, variously, Tertiary sediments and volcanic rocks, Jurassic-Cretaceous limestones, and Quaternary alluvium. Much of the rock is severely faulted, and the area is within a zone subject to earthquakes.. Tunnelling problems have resulted from copious groundwater ingress resulting in rock falls. Although completion had originally been scheduled for 2014, only 26 kilometres had been driven by July 2017.

SOURCE: APAYDID, Ahmet, *et al*., 2019, Water inflow into tunnels: assessment of the Gerede water transmission tunnel with complex hydrogeology. *Quarterly Journal of Engineering Geology and Hydrogeology* 52 (3), 346–359.

Charles Dickens' tunnel in Kent

This is the tunnel under the road at Gads Hill Place in Higham near Gravesend; it's the former home of Charles Dickens and was constructed for him to pass to the 'wilderness' on the other side of the Rochester High Road where his Swiss chalet was sited. The tunnel was used as an air-raid shelter during WWII

SOURCE: Mark Tassell

New metro lines tunnelling under central Vienna, Austria

Tunnel-boring machines are currently at work on two new underground railways below the city centre of Vienna.

The Vienna U-bahn network has been developed since 1976, with extensions into the suburbs in the 1980s and 1990s. The present work under the city centre will give better connections between lines, with a major new central interchange at station at the Rathaus (Town Hall).

SOURCE: ANON, 2019, Vienna building two new underground lines simultaneously. *Modern Railways* 76(853), 80–81.

Tunnel discovered leading to cannabis farm in Victorian theatre

A secret tunnel has been found leading to an underground £4 million cannabis farm in the basement of a former Victorian theatre. The 70ft passage ran from the toilet of a four-bedroom terraced house into a vast space below a row of shops which replaced the theatre in the Sixties.

Detectives believe the illegal factory may have been operating for about a decade, raking in more than £4 million each year. A criminal gang is understood to have tapped into the main power supply via underground cables in order to heat the cannabis plants.

Police found the tunnel after neighbours reported an attempted break-in at the house in Deptford, southeast London, and officers noticed that the toilet floor was hollow. A second vertical shaft was built up to the car park for ventilation and as a possible escape route.

Access to the tunnel was a vertical shaft in the toilet

The vast space, which cannot be accessed by the shops above, is the remnants of the 750-seater Broadway Theatre which was built in 1897. Demolished in 1963, the deep foundations were left behind and the area was redeveloped. The £430,000 property where the tunnel began has been boarded up. Police believe at least one gang member was a builder because of the tunnel's skilful design.

SOURCE: Mail Online, 3 November 2019.

Drug tunnels proliferate beneath the US/Mexico border

Ever since Joaquin 'El Chapo' Guzman was sentenced to life in prison in a New York court in July, the underground tunnels he once used to traffic tonnes of heroin and cocaine across the US-Mexico border have become the center of a new cartel war.

In February, Guzman, 62, was found guilty of trafficking $12 billion worth of cocaine, heroin and marijuana during his reign as the Don of the Mexican Sinaloa Cartel. For decades the vast criminal empire Guzman built had utilized the underground tunnels to cement the Sinaloa Cartel's place at the top of the world's most notorious crime syndicates. Guzman went on to dominate the US drug trade in the late 1980's, following the downfall and eventual demise of Pablo Escobar.

But despite his own arrest and incarceration, Guzman's tunnels continue to prosper as a profitable and viable passageway to flood the US with drugs. However, unlike under Chapo's reign, the Sinaloa Cartel is not the only gang using the tunnels. Criminal organizations are working both in tandem and in opposition to one another over the lucrative routes.

At any one time there are between 10 and 50 tunnels operating. Not all of them are going to active operating at the same time but they will be available. The cartels have invested in a lot of time and effort over the years in building these tunnels. They're picking out the right locations within urban areas, as well as desert, so that they can move the drugs.

The main advantages of establishing an operation in an urban area is that you build your tunnels within buildings, and have it come out in a building on the other side. This allows drug traffickers to hide their trade in plain sight, with the urban backdrop shielding it from the view of authorities.

In the case of the long-established Guzman tunnels, some of them are controlled by one cartel but they lease them out to other groups for a hefty bounty. Often, such payment will include splitting the profits made from the sales of drugs shipped across the border.

Last October, DEA agents shut down an incomplete cross-border tunnel near the city of Jacumba in the state of California less than a mile north of the US-Mexico border. The underground tunnel was highly innovative, containing solar panels designed to run electrical, lighting and ventilation systems, in addition to having two sump pumps to drain the tunnel of any water that gathered inside.

SOURCE: Mailonline, 10 September 2019.

Post-human traces of a lost species on Planet Earth

Ours is, at the time of writing, a rather short-lived (so far) and very invasive and destructive species. *Homo sapiens* has made a mark on every corner of the earth's surface, and below it, and even left litter on the moon and some planets and debris flying around the solar system. With unsustainable population growth and ever-increasing demands on energy, food and materials we may well be heading for extinction sooner rather than later.

A recently published paper reviews what evidence of the human race might be found preserved in the rocks of the earth's crust by any successors to our own species with sufficient knowledge and skills to examine the planet in the distant future, perhaps a hundred million years from now. The authors consider specifically deliberate changes to the rocks resulting from man-made cavities.

From wells, boreholes and tunnels of all kinds to mineral extraction such as coal and metalliferous mining to the reuse of mined cavities and the creation of new ones for storage or waste disposal, they consider increasingly intrusive scenarios culminating in cavities resulting from the testing of nuclear weapons so deep underground that the resulting radioactive debris remains buried.

Such sub-surface nuclear detonations are characterized by extremely high temperatures and pressures, and intense irradiation, which produce cavities containing melted or vapourised rock which on cooling may crystallize as non-natural minerals, or minerals otherwise known only from meteorite impact craters

SOURCE: WATERS, Colin N., *et al*., 2019, Recognizing anthropogenic modification of the subsurface in the geological record. *Quarterly Journal of Engineering Geology and Hydrogeology* 52(1), 82–98.

Aztec tunnel found on the outskirts of Mexico City

Archaeologists have unearthed a secret Aztec tunnel that has been hiding under the bustling streets outside of Mexico City for more than 600 years. Adorned with carvings and paintings, the passageway that dates back to the 15th century was built by Emperor Montezuma I and linked to Tlaloc, the god of water and fertility.

The discovery is part of 15 year-long conservation project around la Calzada de San Cristobal, which is home to a massive structure built by indigenous people hundreds of years ago. The findings were announced by the Mexican Institute of Anthropology and History (INAH), which noted that the wall was adorned with several rock carvings and statues, deeming them a 'huge archaeological value in the city of Ecatepec de Morelos in the central Mexican state of Mexico.

Other items found inside include artifacts made of glass, porcelain, majolica, in addition to remains of statues - there is a decapitated seated figure and what appears to be feet from another statue.

SOURCE: Mailonline, 3 October 2019.

MINES AND MINING

Newly quarried Reigate stone used at Westminster Abbey

The Wealden Cave and Mine Society (WCMS) has recently assisted in the construction of a brand-new addition to Westminster Abbey. This is a free-standing tower on the south side of the Abbey, near the Chapter House. It contains a lift and stairs to give access, by way of a short bridge, to the triforium, a high-level spacious attic area now developed as a museum of items relating to the building and history of the building complex.

The lift shaft is cased in stone, with samples of each and every kind of stone used in the construction of the Abbey. The various stones form horizontal courses for the full 16 metres height of the shaft. Naturally enough, Reigate stone, of which vast quantities were used in the Abbey, is included. WCMS was consulted about sourcing freshly quarried stone, which has not been commercially produced and used since the 19th century.

Original 19th-century quarry face exposed at base of the temporary opencast. Photo Peter Burgess

View towards the Quarry line with WCMS members inspecting the temporary opencast. A stockpile of extracted stone awaiting removal from site. Photo Peter Burgess

The small quantity of newly quarried stone needed was obtained by open-casting an area at Merstham lying between the 1841 Brighton railway line and the 1899 fast line avoiding Redhill. As a result of a crown hole collapse which had some years ago allowed exploration of a small section of quarry tunnels, it was known that some stone remained *in situ* at a shallow depth.

Visitors to the Abbey, having paid the entrance charge, pay an additional £5 to access the new tower and museum. They take the lift to the triforium and the stairs back down to see the displayed stone beds. Several of the stones used, additionally to the material from east Surrey, were from underground quarries elsewhere in England.

SOURCE: JENKINS, Susan, and Tony TROWLES, 2018, *The Queen's Jubilee Galleries, Westminster Abbey.* Scala Arts & Heritage Publications Ltd: 64pp [ISBN 9781-78551-131-8]

Wealden ironstone mines at Horam, East Sussex

The Weald of Kent and Sussex (and a little bit of Surrey) was once England's most important source of iron, worked from the Roman occupation through to early modern times. The profusion of furnaces indeed led to this area being referred to as the 'black country' of England before that term was applied to the West Midlands.

Ernest Straker in 1931 published a substantial volume *Wealden iron* containing the results of his field observations. A reprint was issued in 1969. Numerous furnace and forge sites were identified and recorded. In recent decades this research has been carried forward by members of the Wealden Iron Research Group, with further field investigations and intensive archival research. A successor to Straker's volume is *The iron industry of the Weald* by Henry Cleere and David Crossley, published in 1985.

The ore worked was a sedimentary iron carbonate which occurs patchily in the Wadhurst Clay. Mine sites were readily identifiable as flooded depressions, although there was and is potential for confusion with similar features left by limestone mining and by surface 'marl pits'. Determining which flooded hollows were in fact ironstone mines remains problematic. Details below ground level long remained a matter of speculation.

As a result of the impervious nature of the Wadhurst Clay, and consequently the accumulation of water in the pits, little sub-surface archaeology has been possible. Early speculation was that the mines were 'bell-pits' consisting of vertical shafts widened into underground chambers at depth, rather like chalk deneholes, which are much better known because they are much more accessible. More recently it has been suspected that the pits were exclusively opencast, no more than steep-sided holes open to the sky.

Extensive ground clearance for a new housing development at Horam, near Heathfield, has exposed the traces of numerous pits, of two kinds. Small-diameter pits are interpreted as prospection sites, to see if worthwhile ore exists at shallow depth. Associated larger pits are

thought to be extraction sites where adequate thicknesses of ore had been found.

Digging and working such pits would probably have been during spells of fine weather, as heavy rain would have flooded them and made them useless. No evidence has been reported for working underground laterally from the larger pits.

SOURCE: STEVENS, Simon, 2019, New insights into early modern prospection and ore-mining.

Newsletter: Wealden Iron Research Group, 70, 1–3.

Sirius Minerals' Woodsmith Mine completion in doubt, East Yorkshire

The future of what has been planned to be the UK's first deep mine for 40 years is in doubt as a result of financing problems. Uncertainty over BREXIT and lack of government support have been blamed. Sirius Minerals' Woodsmith Mine was to extract the evaporite mineral polyhalite, a mixed sulphate of calcium, magnesium and potassium, the three metallic elements making it a valuable agricultural fertiliser.

The mine, under the North York Moors near Whitby, is planned to be worked by way of two 1,500 metre deep shafts and a 23 miles long conveyor tunnel to avoid environmental impact on the Moors. As is already the case at the deep Boulby mine for potash further north, near Saltburn, extraction would be continued under the North Sea as well as inland.

An aerial photograph accompanying the cited report shows an extensively developed surface site. At present about 1,200 persons are employed on the project. Estimated reserves of recoverable polyhalite are 290m tones. Completion of the mine in 2021 would offer 2,900 high-earning jobs in the next 50 years.

SOURCE: DAVIES, Bob, and Julia KOLLIEWE, 2019, Future of Yorkshire deep mine in doubt after firm abandons £400m bond sale. *The Guardian*, 18 September 2019, page 39.

New deep coal mine receives a boost

The first new deep coal mine in the UK for decades has moved a step closer after councillors unanimously backed the plans. The West Cumbria Mining Company wants to mine next to the site of the The Haig Pit in Whitehaven that was shut in 1986 after 70 years with the loss of 3,500 jobs.

Artist's impression of Woodhouse Colliery

The Woodhouse Colliery could create 500 jobs, but objectors have said mining will contribute to global warming. Some objectors staged a sit-in on the floor of the council chamber. West Cumbria Mining wants to extract coking coal from the seabed off St Bees, with a processing plant on the former Marchon site at Kells.

A meeting of Cumbria County Council's planning committee heard from several climate change experts and environmental activists who urged members to reject the proposals. Mark Kirkbride, chief executive of West Cumbria Mining, told the Local Democracy Reporting Service that the mine would be a "good neighbour" and was committed to creating jobs. He said that the demand for steel, for which the coking coal is needed, was expected to grow "significantly" over the next 50 years. The mining firm believes there could be up to 750m tonnes of coal available in a 75 sq mile area around the colliery.

SOURCE: *BBC News,* 19 March 2019.

Underwater 'drones' trialled at Ecton copper mines, Staffordshire

The 18th-century copper mines at Ecton, in the Peak District National Park south of Buxton, were once one of the most important British sources of copper ore, and extended to a depth of over 300 metres below a nearby watercourse. There were two main shafts. The winding shaft, up which ore was raised to mine buildings on the hillside above, communicated with at least 10 levels to now worked-out ore bodies.

A pumping shaft allowed water to be removed from all areas below the watercourse, by way of which all the lower levels were drained. The mine was abandoned in the 1850s when pumping was discontinued. What inaccessible cavities were excavated before 1858 appear in a surviving schematic section of that date.

Over three weeks in May 2019 the two shafts were partially explored by the UNEXMIN (Underwater Exploration of Mines) project, a multi-national academic exercise funded by the European Union. Two prototype submersibles, likened to airborne 'drones', have now explored, during ten dives, the two main shafts to blockages at depths of 115 and 125 metres. Technical

A drone is launched at Ecton

improvements are needed to allow exploration of the levels and the workings communicating with them.

The two almost identical submersibles are hollow aluminium spheres 0.75 metres in diameter, connected by an 'umbilical' cable to a heavily instrumented control room at the surface. Each contains five digital cameras to allow views to the front, left and right, and up and down; also sonar and laser equipment, a multi-spectral scanner for mineral identification, and equipment for testing water and radioactivity.

The control room at the surface, housed in the Ecton Mine Educational Centre, contains banks of computerized monitor screens and data recording and processing equipment. In the long term it is hoped that the technology trialled at Ecton will have commercial applications in flooded mines worldwide. The cited source includes a copy of the schematic mine section of 1858.

The implications for European Union funding for the continuance of this project if the UK ceases to be a member are not discussed.

SOURCE: BARNATT, John, and Richard SHAW, 2019, Peak District mines – observations and discoveries – part 70. Exploring the flooded depths in the Ecton mines during May 2019, at Deep Ecton Mine, SK 0963 5813. *Newsletter Peak District Mines Historical Society* 172, 11–14.

Mine workers rescued in German mining accident

Thirty workers were rescued after being trapped 2,300ft underground in a mine explosion that injured two people in Germany. The blast at the former potash mine left workers stuck some 2,300 feet underground at the mine in Teutschenthal near Halle in eastern Germany, around 95 miles from Berlin.

Teutschenthal mine

Rescuers and firefighters battled to bring them back to the surface via a mine shaft that survived the explosion. Shortly before lunchtime, police in the nearby city of Halle announced that everyone had been rescued from the mine. One person was feared to be seriously wounded after the blast while another was slightly injured.

The workers who were trapped had taken refuge in a designated safe area of the mine where oxygen was available. Authorities are now examining the cause of the explosion and assessing the damage it may have caused. Early indications were that no harmful substances had spread into the wider environment.

The potash mine was closed in 1982 but is being used to deposit mining waste from elsewhere. Around 100 people are employed at the site.

SOURCE: *Mail online,* 8 November 2019.

Suggested use for abandoned mine shafts

A newly established Edinburgh firm called Gravitricity has suggested a means of, in effect, storing electrical energy generated cheaply by renewable methods at times of low demand for later use at times of peak demand. Such a facility has been in use at the Pumped Storage station at Dinorwig in North Wales since the 1970s, where electricity generated in off-peak hours is used to pump water to a high-level reservoir.

At times of peak demand, the water runs back down through generators to produce current fed into the National Grid. In the days when most mains electricity was generated in coal- or oil-fired power stations, this made economic sense, to keep the generators working 24 hours a day. Starting-up and shutting-down old-style power stations was time-consuming, unproductive and uneconomic.

The Gravitricity scheme is to suspend heavy weights above deep shafts. These, when released to fall, produce kinetic energy to turn turbines to meet peak demand. Overnight, at times of low demand, cheaply produced electricity from renewable / sustainable processes such as wind turbines would be used to raise the weights, thereby storing the energy as potential energy.

There are obviously 'ifs' and 'buts' as with any new idea. Although almost every county in England has in the past had mines of some sort, many of these were drift mines rather than worked via shafts. And many such shafts would not be deep enough for use.

Many shafts have been backfilled – in the Kent coal field, for example, by bulldozing old spoil tips down them. There are numerous very deep shafts to the Cornish metal mines, but some of these are steeply inclined following mineralized veins, rather than vertical. What would be required for the Gravitricity scheme would be very deep, wide, and perhaps brick-lined shafts clear of ladderways, air ducts, cables and the like. On what sort of surface the weights might land, time and time again, is another consideration.

SOURCE: AMBRISE, Jillian, 2019, How weights dropped into mines could save energy. *The Guardian*, 21 October 2019, page 10.

We rarely receive review copies of books from authors or publishers, although these, if relevant, would always be welcome. Most titles noticed have been purchased by Paul Sowan and added to his personal collection.

NAMHO 2019 - Llanafan

Tim Wellburn

WEMYSS: A cheerful group, including SubBritters Tim Wellburn, Richard West, Neil Iosson, John Smiles, Nigel Ostler-Harris and Robert Hall, prepare to descend into the Wemyss adit, en route for Frongoch. Photo Clive Penfold

July 2019 saw the NAMHO Conference return to the Cambrian Mountains and, specifically, to the largely lead and zinc mines of the Central Wales Orefield. The last Welsh Conference, in 2013 (written up in *Subterranea* 34), had been based at Aberystwyth; this time we were at Llanafan, hosted by the Cambrian Mines Trust. As usual, there were parallel programmes of lectures and site visits and, once again, most of the SubBrit contingent headed underground.

A group of us - Robert Hall and Emma Scheck (who were helping to deliver the Conference), Clive Penfold, Richard West and I, had long ago decided to stay at The Hafod Hotel at Devil's Bridge, a rambling edifice built for intrepid Victorian excursionists to the famous falls. It boasted a bar with draught beer and a very acceptable restaurant, both of which substituted adequately for the splendid railway station-based Wetherspoons which had sustained us in Aberystwyth. Fortunately I had been allocated one of the hotel's unimproved rooms with a forgiving brown lino-floored bathroom; others struggled with the challenge posed by pale new carpets, white rugs…and mucky caving gear.

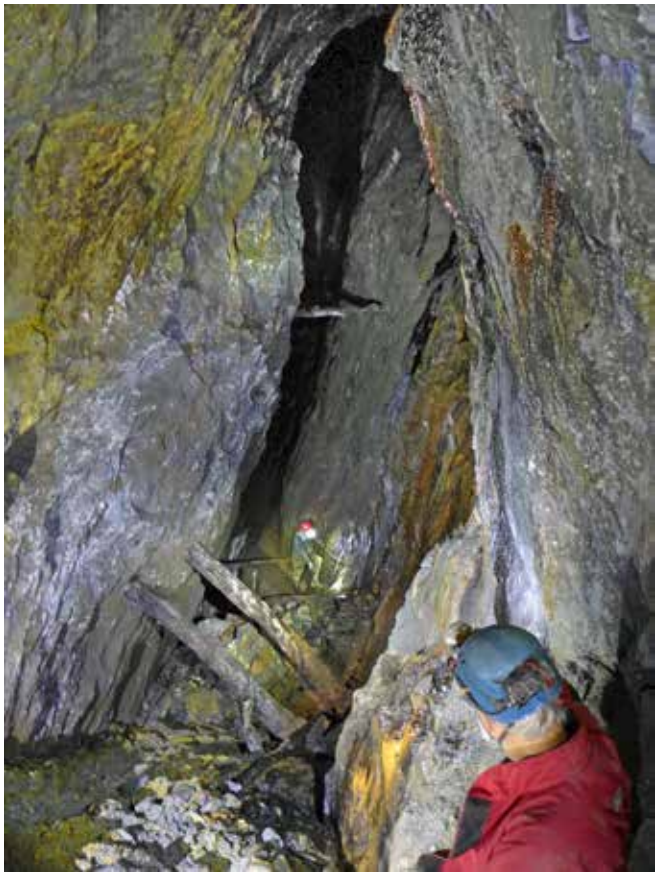
Thursday

Henfwlch Mine, Nantymoch

A good gathering of SubBritters arrived for the inaugural Thursday afternoon visit to Henfwlch Mine, near the shore of Nantymoch, a trip which had not been available in 2013. This is a relatively small mine, probably of 18th-century origin, and worked for lead, zinc and copper, at intervals throughout the 19th century.

A long straight adit leads to stopes and side passages. We made a hand-line descent into a large stope down steeply sloping infill and traversed across what was clearly a false bottom. Roy Fellows, leading, said that this had dropped ten feet in the decade since he had first accessed the area. We inspected various artefacts including two wheelbarrows, one in exceptionally good condition, and a well-preserved winze kibble.

The main surface remains – looking rather surreal in the midst of fir trees – are a pair of stone-built fireplace hearths, one with a tall chimney. From Henfwlch we retired to the Hafod for a convivial evening with friends from Shropshire Caving & Mining Club.



HENFWLCH: The traverse across the bottom of the large, partly infilled stope

Friday

Level Fawr, Pontrhydygroes

Level Fawr drained the mines of Logaulas, Penygist, Glogfach and Glogfawr and eventually intersected twelve lodes, five of which were highly profitable. John Probert of Shrewsbury, who controlled many mines in the area, had started driving the adit in 1785, aiming to intersect Logaulas Main Lode. Progress was slow and it was some 30 years before a lode was cut, only to prove valueless, resulting in the abandonment of the very expensive adit.

HENFWLCH: A pair of stone-built fireplaces are all that remain of the mine's surface buildings

A decade on, in 1824, the lease passed to the Williams family, Cornish mining adventurers, who resumed the driving and, a short distance further on, broke into the true, and very rich, Logaulas Main Lode: the one found previously had been merely a stringer. By one account **[1]**, at some point this lode was lost again. In any event, in 1833, facing losses from falling lead prices, the Williams' surrendered this and all but one other of their mine leases. Control then passed to the Taylors, also well known – and very successful – Cornish mine adventurers, who were able to re-establish profitable operations, buoyed by a sustained improved market.

LEVEL FAWR, PONTRHYDYGROES:
The fine dressed stone portal bearing the inscription "THIS LEVEL WAS COMMENCED A.D. 1785".
Ioan Lord, leading the trip, briefs participants

If our initial trip to Henfwlch had been benign, our decision to revisit Level Fawr at Pontrhydygroes was little short of masochism, certainly for my 6' 2" frame. This great cross-cut is the longest adit in mid-Wales, initially running straight into the hillside for a third of a mile, with a total length of just under one and a quarter miles (and as much again, if lode workings are included). At its furthest accessible point, one is 742 feet below the surface.

That is all fine, except for the 2-300 yard section where silting has reduced the headroom to about three feet. To avoid crawling through the icy water flow underfoot, this can just about be negotiated, with effort and in short stages, in a weird sideways crouch, but the things this does to one's anatomy are (in my case, at least) still the subject of medical research.

LEVEL FAWR, PONTRHYDYGROES: "Waste-not, want-not!": a ladder constructed by miners using a surplus spanner as one of the rungs

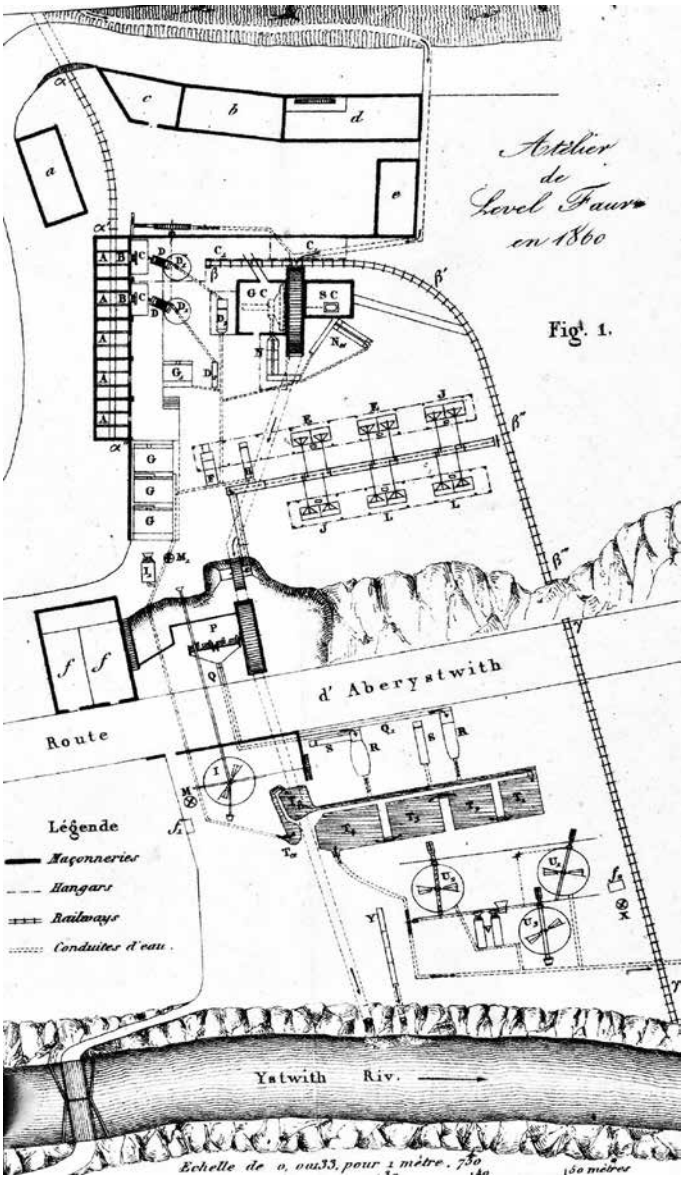
At Logaulas a collapse is easily negotiated via a plastic pipe, giving access to Penygist, where drifts head off east and west, the latter opening out into stoping. The main adit continues for about another 750 yards to a significant vertical discontinuity. Around 1872 the Glogfach 118 fathom level, which had been driven north from Skinner's Shaft towards Level Fawr, broke into it about 16 feet above floor level. We climbed this 'step' up a short ladder, trying to avoid the associated waterfall. The latter was the consequence of a deliberate piece of hydraulic redesign, in which the floor of the Glogfach level had been cut down to reverse the drainage flow away from the pumps of Skinner's Shaft and discharge instead into Level Fawr.

Skinner's Shaft is now collapsed, but Ioan Lord , who was leading the trip, told us that water can be heard cascading down it – except after particularly wet weather when it becomes silent, the inference being that it is then full of water, which rather discourages thoughts of an exploratory dig in that direction!

Ore was trammed through Level Fawr to the dressing floors at Pontrhydygroes until at least the late 1880s, but both were abandoned when the Lisburne Mines

LEVEL FAWR, PONTRHYDYGROES: Fine horizontal strata in the rock face of a stope driven from the main adit

Company collapsed in 1893. Mining resumed at Glogfach from 1907 to 1920, but Level Fawr served only for drainage - a role it still fulfils.



LEVEL FAWR, PONTRHYDYGROES: An 1860 plan of the dressing floors, displayed on site, next to a reconstruction of one of the waterwheels

Cwmystwyth - Level Fawr

CWMYSTWYTH: Part of the extensive dressing floors, with numerous workings on the flanks of this 'mountain of lead'. Level Fawr is at a slightly higher level in the middle distance

"Fawr" means "great" and some might think that one Level Fawr in a day was sufficient; however, we had elected to return to the major lead mines of Cwmystwyth, not least to inspect "*The Steel Road*", Roy Fellows' (aka The Cambrian Mines Trust) latest piece of civil engineering. In 2013, when the mines had just been acquired for preservation by the Trust, access through the initial collapse in the adit was through two plastic pipes, not exactly aligned, the second with an awkward slot cut in it. One emerged about three feet above floor level and extracted oneself with as much dignity as possible by grasping the adjacent ore wagon.

CWMYSTWYTH, LEVEL FAWR: Richard West seems to regret becoming a miner? A section of the tramway with the ore wagon that used to facilitate entry to the mine before the advent of "The Steel Road"

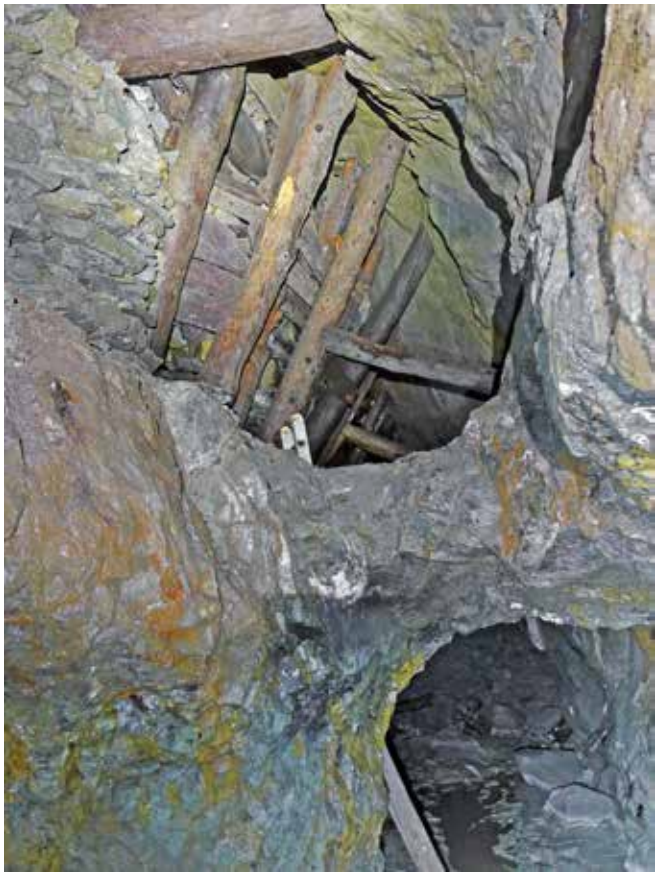
Roy, who was leading the trips that afternoon, has now replaced this crawl with a solidly constructed steel-girder-framed walkway. He was still occupied with another group at the time of our arrival in the mine so, having made our number with him, we were able to explore as we wished until he was free to show us round.

CWMYSTWYTH, LEVEL FAWR: The skipway, plunging into the depths of the mine. Note the SRT rigging in place

We inspected some of the stopes with their massive reinforcing stemples and a number of well-preserved ore chutes and trackwork. The near-vertical timber-framed skipway, complete with rails, which extends out of torch range in both directions, up through the stope and down into the lower workings, is a piece of engineering that cannot fail to impress.

CWMYSTWYTH, LEVEL FAWR: The heavyweight timberwork of the skipway ascending the stope

As well as improving the entry to the mine, Roy has secured access to its further reaches by significantly reinforcing the original huge retaining timbers in Level Fawr, which had rotted to the point where they were visibly sagging under the weight of the deads stacked behind them. New blockwork with a concrete fill has now been installed, disguised with a facing of stone cladding that resembles a prototypical packwall.



CWMYSTWYTH, LEVEL FAWR: An incipient collapse averted: part of the 'packwall' (top left) hiding the new reinforcement. The level passes under the rock arch and runs along the foot of a massive stack of deads in the old stope

Fish & Chips, Books and Kit

Friday evening marked the formal 'Welcome' to the Conference followed, according to immutable custom and practice, by a fish and chip supper. This was freshly cooked *in situ* by a team from the Hafod, and was excellent. Mike Moore was there, so it was good to catch up with him and to peruse his usual array of enticing books, including some timely copies of David Bick's indispensable monograph on Frongoch **[2].** Starless River was also there, providing the opportunity to talk kit with Tony Seddon and to acquire some new bits: in my case, a caving suit that I'd been putting off buying until I could try it on, and a couple of caving bags, as being much easier to de-mud than my old rucksack.

Saturday

Alderson's & Herbert's Levels, Cwmystwyth

This was another SubBrit gathering, as Richard West, Clive Penfold & I were joined by John Smiles, Julian Nowill and Nigel Ostler-Harris, who had emerged from their caravan for some early morning exercise. It had not been billed as a work-out, but these levels are quite high above the valley floor and Ioan Lord is young and fit, and it took some effort to keep up with him!

The two levels are driven one above the other. The higher and earlier (18th-century?) one is shown on plans as Herbert's, with the 19th-century Alderson's Level below it. However, the Conference was hearing a

ALDERSON'S & HERBERT'S LEVELS, CWMYSTWYTH: Ioan Lord briefs the usual suspects on the climb up to Alderson's & Herbert's Levels

paper that morning that argued that Herbert's Level had effectively ceased to exist, having being stoped out (in places to surface) by Alderson's, presumably rendering the lower level innominate.

ALDERSON'S & HERBERT'S LEVELS, CWMYSTWYTH: Stulls in a stope open to daylight. The winze being studied connects with, and drains into, the level below

We followed the cross-cut of the upper level to its intersection with the lode, which was worked into some high stopes, often passing under runs of stulls supporting heaps of deads. In one of these areas we had to edge round a winze in mid-floor, which was serving as a drain.

Eventually our way forward was barred by water and wooden shuttering retaining a collapse. The view back and skyward from here was quite dramatic, with

light and water cascading into the depths of the stope, silhouetting the decaying timber work and remnants of false floors high overhead.

ALDERSON'S & HERBERT'S LEVELS, CWMYSTWYTH: A study in light & water - and of the passage of time

Returning to surface, we circled down the hillside, preferring a longer but surer approach to the lower adit than the steeper route carved by the stream which flowed past the entrances to both. This level had been driven beyond the lode for a short distance as a blind heading. As before, a drift off it led to a series of heavily timbered stopes. These seemed even wetter – particularly where the other end of the winze we had seen before discharged in a waterfall directly overhead. This did at least serve to demonstrate that the two adits were similarly aligned, exploiting the lode at different depths.

ALDERSON'S & HERBERT'S LEVELS, CWMYSTWYTH: The enticing entrance to the lower of the two cross-cut levels

Alltycrib, Talybont

Talybont lies to the north of Aberystwyth, not far from Ystrad Einion mine with its superb underground waterwheel. The latter mine was also on offer, but we had inspected it previously, including during NAMHO 2013 and unfortunately did not have time for a return visit.

Our intention, at the time of booking Alltycrib, was to have gained sufficient competence in SRT to undertake the easy pitch down a slope shaft to secure access to Deep Adit. This would have rewarded us with the remains of a horse whim, pumping-bob and flat-rod supports, plus a pair of kibbles. In the event neither Richard West, Clive Penfold nor I had managed to do any prior SRT practice, and clearly this was not the time to start learning. So instead, we opted for the self-guided surface- and walk-in underground trip.

The notes stated that there were two adits to be explored: Wilkinson's and Myddleton's. The latter, intriguingly, was described as "an Elizabethan coffin-level and site of an 1870's underground steam engine".

ALLTYCRIB, WILKINSON'S LEVEL: The point where the adit forks, the branches leading to separate ore working areas

Trampled undergrowth quickly led us to the inconspicuous entrance of Wilkinson's Level. This commences as a cross-cut driven straight into the hillside, with water *just* below Wellington boot height. Eventually a fork is reached. The right-hand branch leads past a shaft to a rather convoluted pattern of workings, none of which seem to have amounted to much. The branch to the left drifted Wilkinson's Lode, opening into a narrow stope which breaks surface at one point. It continues past a large, deep water-filled winze, to further narrow stoping. This ends abruptly with short blind headings upwards and downwards, suggesting that the miners had lost the lode at this point, and tried but failed to re-find it.

The surface, which we explored thoroughly looking for Myddleton's Level, was pockmarked with fenced-off (often very overgrown) shafts and/or open stopes - or maybe even adits. This was interesting but also increasingly frustrating as we criss-crossed the area, like Long John Silver's men searching for Flint's cache.

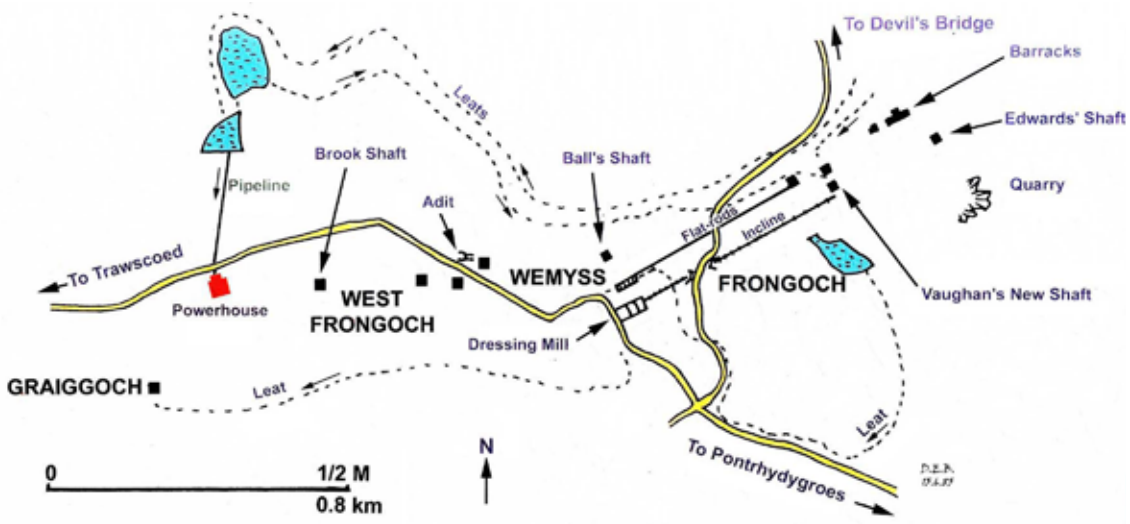
ALLTYCRIB, WILKINSON'S LEVEL:
The author contemplates the winze - and the best way to avoid falling into it. Photo Clive Penfold

Eventually, with beer o'clock coming on, we gave up the quest. Roy Fellows later remarked that "perhaps it needed digging out again"!

That evening was the Conference Dinner, another convivial event, providing an opportunity to catch up with old friends one hadn't managed to bump into hitherto. Robert Hall very kindly drove the Hafod gang to & from the Llanafan venue, allowing the rest of us to sample the draft beers properly.

Sunday

Frongoch



left of "WEMYSS" and worked our way east as far as Engine Shaft (not marked), a little short of Vaughan's New Shaft. The plan shows the key features built at the turn of the century in a doomed attempt to revive the mine

This trip was scheduled to take most of the day, with a welcome mid-morning start. The 'technicalities' were described in the NAMHO programme as: "*Moderate but a longish trip with some stooping…Thigh deep water in places. Optional swims, plus a grotty crawl. Most of the mine can be seen without getting wet."* This last, slightly implausible, reassurance was welcome.

Frongoch produced over 100,000 tons of lead ore (galena) and zinc ore (blende) over its lifetime, which effectively spanned the 19th century. Like Level Fawr at Pontrhydygroes, it was successively under the control of John Probert, the Williamses and John Taylor & Sons. The Taylors worked the mine until the late 1870s, when prices started falling again, never to recover. By then they had reached the 117 fathom level and the lead was largely worked out. However, the huge remaining blende deposits enabled John Kitto of Llanidloes to work the mine for a further twenty years.

FRONGOCH: The powerhouse built by the Belgian company Société Anonyme Minière

This should have been the end of underground working but, in an extraordinary coda, in 1898 a Belgian company decided that all that was needed was massive investment in modern technology. They built: a very splendid hydro-electric generating station (with steam-powered back-up) in order to electrify operations; an extensive and well-equipped new dressing mill; a half-mile chain-operated tramway to feed it from Vaughan's Shaft; and a new headframe and associated works at the latter. Predictably they quickly became insolvent and, in 1904, everything was auctioned off.

Access to Frongoch is currently via an adit at the western end of Wemyss mine. This adit broke through into the Frongoch 24 fathom level around 1848 and thereafter served to drain it. We were spared a crawl through its portal stream, entering via a manhole and a couple of short ladders a little higher up the hillside, where I assume a stope had reached daylight (see the headline photograph).

FRONGOCH: Remains of part of the new dressing mill built by Société Anonyme Minière

Our "longish trip" involved a 3/4 mile underground walk (each way) taking in the length of the Wemyss adit to the boundary with Frongoch and thereafter the Frongoch 24 fathom level to Engine Shaft, beyond which it is blocked by a fall **[3]**. Originally, this level continued much further eastwards. With all its numerous changes in direction, cross-cuts and exploratory blind headings, Bick estimated its total length at about three miles.

The water depth in the adits never reached much above knee height, but care was required not to fall off, or trip up over, the remains of the sometimes submerged Victorian plank walkway. The Wemyss adit twists and turns, on a broadly ENE heading. Its junction with the

FRONGOCH: The pump rods in Engine Shaft at the 24 fathom level. Photo Clive Penfold

Frongol 24 fathom level is a bit complicated. The two adits parallel each other for about 100 yards, throwing off various blind headings, but connect via a linking cross-cut at Boundary Shaft. The latter is blocked by debris, both up and down. An iron kibble lies nearby.

Having negotiated this, we followed the wandering Frongol 24 fathom level in a broadly NE direction (we would explore its westerly continuation on our return). After a bit of a muddy crawl up over an obstruction, we transited a heavily stempled stope before reaching Williams' Shaft. The adit swings round this shaft (also now blocked, up and down) to avoid draining into it. Some distance beyond this, the adit splits. The branch to the right leads to a large stope; that to the left to Engine Shaft. The way beyond both of these is blocked by collapses.

Engine Shaft is open to the sky although a mound of debris has created a false floor at the 24 fathom level, out of which rise the substantial timbers and iron bracing of the pump rods, reaching high up the shaft towards daylight. The shaft is equally impressive at the surface, boasting the rare sight for North/Mid-Wales (where water was the normal power source) of a Cornish engine house built for a 60-inch cylinder pumping engine. Unusually, it has two balance-bob pits, a second having been added to support the increased weight of the pump rods when the shaft was deepened. Sadly, this historically important structure, with its attached boiler house and coal store, seems to be in a terminal state of dilapidation. It was once one of three adjacent engine houses, the others being a 40-inch cylinder pumping house, built by Taylor in 1841, and a 25-inch cylinder steam winder and crusher.

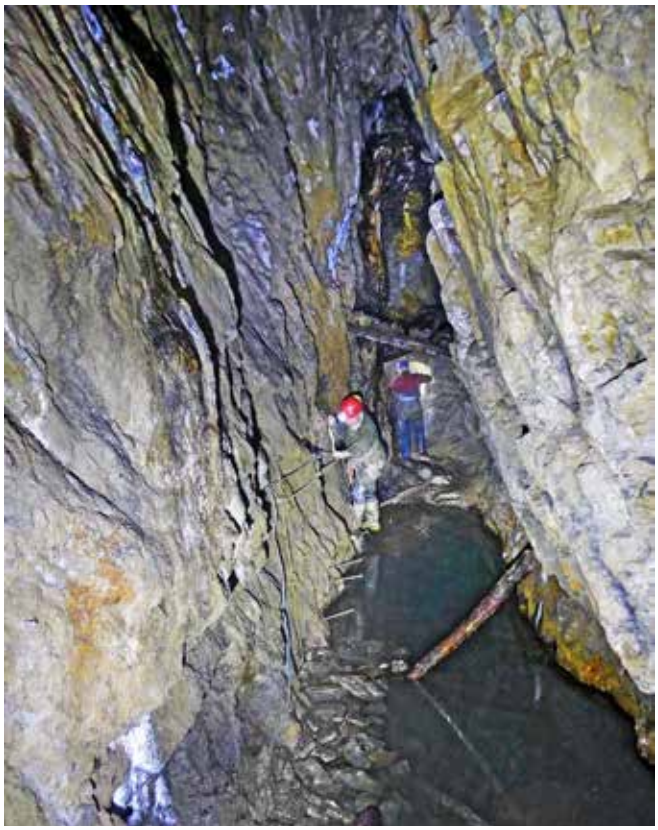
FRONGOCH: The Cornish Engine House at Engine Shaft. Photo Clive Penfold

Underground, we examined a well-preserved wooded wheelbarrow in one of the blocked adits leading off from the shaft, and then headed back to see parts of the mine we had not looked at previously. Between Williams' and Boundary shafts we climbed a laddered rise to the narrow 18 fathom level. This was remarkable for its quite beautiful

array of hydrozincite flowstone. Those with a passion for mud indulged in a further crawl at the end of it to inspect Roy Fellows' latest dig. I elected to enjoy this vicariously.

FRONGOCH: The extensive hydrozincite flowstone in the 18 fathom level

Returning to the 24 fathom level, we carried on along its western continuation past Boundary Shaft, ignoring, for the time being, the cross-cut back to Wemyss. This led to three flooded stopes, one with an interesting catwalk of iron rods hammered into the rock just above water level, which we traversed, helped by one of Roy's hand ropes, to inspect old miners' boot and clog marks in the mud. Various winzes and rises formerly would have led to other parts of the mine. From here we retraced our steps, via Wemyss, to emerge blinking in the sunshine – decidedly grubbier than before.



FRONGOCH: Clive Penfold traverses one of the flooded stopes in the 24 fathom level, to the west of Boundary Shaft

Monday

Rhiwrugos/Erwtomau

We had planned to conclude with a pair of mines described in Ioan Lord's superb book **[4]** on trips led by him: Pantmawr and then Rhiwrugos/Erwtomau. The former promised "impressive mineral formations and stopes", as well as a wooden wagon body and the remains of an underground bob-pit at the engine shaft, all at the minor inconvenience of waist- or maybe chest-deep wading. For a variety of reasons, of which aquaphobia really was way down the list, we ended up visiting only the second mine, on an additional morning trip which Paul Thorne had nobly volunteered to lead, despite not having been there before.

This excursion was memorable for our pioneering ascent of the valley side, the path we were attempting to find/follow on the map having been moved across a gully. Eventually, just after crossing the track of the Vale of Rheidol Railway (we could have come by train!) we found the concrete foundations of the dressing mill, beyond which was the entrance to No.2 Adit. The mine had reopened in the early 20th century (as the Erwtomau Mine), exploiting the recently opened railway (1902). The mill was built in 1911 as part of this venture.

RHIWRUGOS: The 40 ft-high stope running east from the cross-cut adit. Notwithstanding evident decay, this side of the mine is still accessible and we negotiated it with due care

Lord recounts that Rhiwrugos was the most extensively worked mine in Rheidol United, with nine adits and an engine shaft which allowed the Main Lode to be worked over a vertical range of 600 feet. It was also said, in the

late 19th century, to be one of the oldest worked mines in the county. The earliest workings are extensive open cuts. There is also an adjacent coffin-level, which some of the group went on to inspect (we had run out of time).

No.2 Adit, a cross-cut, follows a meandering path for about 100 yards before striking Rhiwrugos Main Lode. Drifts were driven along the lode in both directions, with extensive stoping. In the middle of this junction of adits is No.1 Winze, originally a 60 ft ladderway to the lower levels of the mine. The floor here comprises deads supported by rotten timbers: we negotiated it with care and without dawdling.

RHIWRUGOS: The badly rotted stulls and collapsed false floors in the stope to the west of No.1 Winze

In fact, the whole mine requires great caution. Parts of it are simply too dangerous to venture into, due to the rotted state of the timbers holding back stacks of deads and supporting false floors (or the remnants of them). The western side was inaccessible (at least, to us): whole sections of false floor had collapsed into the stope leaving gaping holes. Instead, we ventured down the eastern drift, conscious that we were walking on another false floor, and that the low headroom encountered in places was caused by the rotted roof timbers yielding under the weight of loose rock. The drift opens into a number of tall, narrow stopes, with many stemples remaining in place high overhead. The forebreast (end of the drift) is reached shortly beyond these stopes.

RHIWRUGOS: Richard West studies the state of timberwork in one of the high eastern stopes on the main lode. The ladder once gave access to a working platform

Before this point, a short 1859 drift drives off to the NW, following the "New Lode". This is partially backfilled. It intercepted a rich shoot where the extent of the stope is visible through collapses in the floor. Just beyond this the drift connects with the northern continuation of No.2 Adit, but does not continue across it as the New Lode proved barren west of here. We backtracked to regain the main adit in order to inspect the stope from the other side, and then continued a further 60 yards to its end where a pile of rock marked the miners' final blasting… and the end of our NAMHO explorations.

From Wales to Cornwall…and Shropshire

Our thanks are due to the Conference organisers, especially to Roy Fellows who worked tirelessly to set up a splendid range and number of mine visits to satisfy almost every demand; to Peter Claughton who coordinated the lecture programme; and to the large team of volunteer mine leaders and administrators who helped to deliver and manage the trips and events.

Next year's NAMHO Conference will be in Cornwall, from 3-6 April 2020. The theme of the conference is "*Copper, tin and gold*". Booking should open around the end of this year. NAMHO 2021 is planned for Shropshire to coincide with the Shropshire Caving & Mining Club's 60th anniversary. Planned dates are 1-5 July 2021.

GLOSSARY

Coffin-level: Old, hand-dug adit, with a small cross-section, tapering above and below shoulder height.
Cross-cut: Adit driven to access a lode.
Deads: Waste rock, stacked within a mine.
Drift: Adit driven along a lode.
Lode: Ore-bearing vein.
Stemple: Reinforcing timber wedged across a stope.
Stope: High, narrow cavities where the lode has been worked to extract the ore.
Stull: Timber wedged across a stope to support a false floor or otherwise retain deads.
Winze: Underground shaft driven downwards from an adit (if driven upwards, it is a 'Rise'.)

FOOTNOTES & REFERENCES

All photographs are by the author, unless stated otherwise.

[1] Smyth W.W. *Memoirs of the Geological Survey* Vol 2 Part 2, 1848. Recounted in David Bick's indispensable monograph (see [2] below)

[2] Bick, David *Frongoch Lead & Zinc Mine (British Mining No.30),* Northern Mine Research Society, July 1996

[3] Roy Fellows' 1995 full description of the route (which he dug through) is at Appendix V of Bick's Frongoch monograph. At the time of our visit, he was trying to extend access by digging through another fall ("The Birmingham Underpass"). I think this was the "grotty crawl" referred to in the NAMHO visit description.

[4] Lord, Ioan *'Rich Mountains of Lead' - The metal mining industry of Cwm Rheidol and Ystumtuen,* The Vale of Rheidol Railway, 2018. This is a beautifully produced book, describing the history and the surface and accessible underground remains of these mines. It is richly illustrated with historic and contemporary photographs (many underground), diagrams and plans and cross-sections of the mines. Highly recommended.

Until next time…

A tale of inconvenience?

Three case studies of the reuse of derelict underground toilets in Manchester

Phil Catling

The bar filling one end of the Temple, with very limited space to sit along one side

The lack of suitable facilities comes up regularly in the letters pages of the Mancunian local press, bemoaning the loss of those wonderfully evocative, dank, dark and dangerous public loos the Victorians loved so much. Inaccessible to anyone with walking difficulties, the slippery steps, rank smell and strange graffiti are branded in the memories of those of us 'lucky' enough to have used them for their original purpose.

When these relicts are found to be open and in use, like the ones in London near Aldwych closed tube station or by the Maritime Museum in Greenwich, they often now have gates, security systems and even attendants on site.

Manchester city centre has its fair share of underground toilets – most lost forever to the general public, covered over and left to the mice and spiders. But there are a few which have found a new life, repurposed into bars, electrical substations and even art galleries. This article will focus on three of the repurposed loos: one palace of Victorian splendour, one with Art Deco gracefulness, and one 1960s' concrete brutalism.

Nothing to go on

Anti-social behaviour and the terrorist threat meant that Manchester had closed virtually all remaining public conveniences by 1990, instead championing a policy of stores having available facilities. Manchester centre famously had only 35,000 actual residents in the early '90s so revenue and taxes were used to redevelop transport links, shopping and nightlife ahead of public loos.

First up in age and the easiest to visit is the venerable Manchester institution, the 'temple of convenience' (no capitals, very '90s), now shortened to 'The Temple'. The Temple was built in the 1890s as a gentlemen's toilet, located in the theatre district in an attempt to reduce the amount of public urination after late shows. Situated one street away from the Rochdale canal and near the River Medlock, ease of disposal was also a factor.

The toilets have been a dive bar since the late 1980s after the loos had been closed for some time, famed among Manchester's student and alternative groups as having 'the greatest jukebox in Manchester'. A tiny space

with a distinct underground smell, The Temple is a rite of passage during Freshers' week and a fixture on the memory list of anyone who returns for reunions.

Temple of Convenience entrance, showing double original access and gas lighting

Around the corner from the Ritz nightclub, across the road from the old location of Jilly's Rockworld and halfway between Fifth Avenue and 42nd Street – all busy alternative and rock venues – The Temple has a rapid turnover of groups meeting up, staying for one drink and heading on.

In layout, the space is a traditional Victorian underground toilet, designed exclusively for men; the original tiling lines the two staircase entrances, one now with a ramp that can be lowered to assist with access for wheelchair users. Between the two railed entrances is a surviving Victorian gas lamp, now used as a hanging post for an illuminated beer sign.

At one end of the narrow room are the remaining cubicles, now a unisex toilet. This space is often used to display art from regular patrons or as a tiny gallery space for Manchester Metropolitan University art department. Under an original arch off to one side is a tiny room for storage, once the location of the attendant.

Temple Bar

The single long space has tiny tables and 1980s bench seating, leading up to a bar that fills the whole of one end. Low and dimly lit, the bar has two distinct atmospheres, empty during the day except for a few regulars, then as the evening comes on, the space becomes a crush of vintage army jackets, long hair and converse trainers.

At busy periods the easiest way to get a drink is to ask if a person crushed against the bar will pass it over the heads of the crowd. Seats are prized possessions, jealously guarded when loo and cigarette breaks are taken. Art lines the walls, with vintage beer signs and advertising that weren't vintage when they were put up.

Centre of the room in a prominent position is a huge poster advertising a concert by local band *I am Kloot* at Victoria Baths. The singer of *I am Kloot*, Scott Alexander, owned The Temple and another local bar along with local label skinny dog records before his untimely death in 2018 aged only 43.

Retro décor in the Temple, where the cubicles have been removed; the steps in the background show the relatively shallow depth of the toilets

The interior of the Temple, showing local art and a retro poster from I am Kloot

The bar is famous as the original location of the lyric 'There's a hole in my neighbourhood, down which I cannot help but fall' in *Elbow*'s hit 'Grounds for divorce'. *Elbow* lead singer Guy Garvey is a regular at the bar and *Elbow* and *I am Kloot* were label mates.

Rising above such inconsequential items as the smoking ban, health and safety regulations and fashion, The Temple seems to endure and exist in a bubble, rarely changing but being discovered by a new group every few years, only for them to be replaced in their turn. Long life and good luck to them.

Current situation

Moving from Theatreland to the historic medieval heart of Manchester, close by the 1712 church of St Ann is a strange but wonderful sight. Part Art Deco style and lines, part Mad Max metal edifice. The stepped entrance is similar to a Victorian toilet, but there is only one entrance and that is securely protected.

Closed by the 1920s, this Stygian space was swiftly converted into an electricity substation with the loss of one entrance. The above-ground features were removed and a beautiful Art Deco wall proudly engraved with 'MCED – Manchester Corporation Electricity Department'.

Art Deco entrance to the St Ann's Square toilet, with 1920s lines and benches overwhelmed by later security fencing. Fencing added when converted into an electrical substation

As time progressed and security of substations became more important, a grille was added over the entrance. This was enhanced after the 1990s terrorist incidents and 1996 bombing of Market Street, just around the corner. The substation now has a huge cover of rails and grilles, sitting like a sculpture next to a strange pineapple-shaped fountain.

Metal bars and netting covering the original entrance to the St Ann's Square underground toilet.

Initials of Manchester Corporation Electricity Department engraved in the Substation entrance

The 1920s seating is still useable, but the rails project out slightly, making it impossible to sleep here. This has been referenced in the siting of the sculpture *Jesus the homeless* by Canadian artist Timothy Schmalz outside St Ann's Church nearby.

Anyone got the keys?

Access is impossible for safety reasons as the site is an active electrical location, security and due to the substation having just a single entrance. No interior photos have been found online. It would be interesting to see what the 1920s designers kept of the original Victorian features so if any Sub Britters work for Electricity North West and can get access, let us know.

And now number three. Moving forward and out to Manchester's Northern Quarter, we reach Stevenson Square, hub of the bus routes out to the surrounding towns and location of our most recent underground convenience. With a relatively short life, these brutalist loos were only constructed in the 1960s, and closed by the late 1980s along with other central Manchester toilets.

Stevenson Square toilets, now used as a street art gallery in the busy centre of the arty Northern Quarter

Never converted internally, the loos are in a derelict state, despite being bought and sold a number of times. With planning permission for conversion into an exclusive nightclub, the loos would seem a lucrative investment but never actually get converted, merely passed on to a new owner.

With two entrances these are the first loos to cater for female visitors. Built in a mirror design with two sets of separate toilets, each accessed by their own set of steps, the loos are lit by glass bricks set into the floor above and have two tall vent stacks to assist with air conditioning and cooling below.

As the loos have never been converted or changed, how do they fulfil our requirement of 'reuse'? Well, the outside and above-ground sections of the loos have been repurposed as a garden and art gallery for graffiti and mural artists.

Curated by www.outhousemcr.thecolouringbox.co.uk and supported by businesses surrounding the toilets such as Fred Aldous art supplies, Soup Kitchen and Eastern Bloc record (and cake) shop, the artwork changes every three months.

The murals often reference recent events such as the Ariana Grande bombing or refugee and environmental issues.

Much larger than The Temple due to being built for both sexes, the toilets have a central block which was covered over as part of the Stevenson Square green makeover in 2012. This led to the roof of the original entrances becoming a lawn and wildflower garden. Manchester icon the worker bee is well catered for and encouraged with specialist planting through the year.

Capped entrance, glass brick lighting and concrete vent stack of the Mens' side of the Stevenson Square toilets, built in concrete and showing 1960s Brutalist design

Lost in translation

Two other underground conveniences now lost to the public are situated in central Manchester. Firstly, in Piccadilly Gardens, are a set converted into another substation with no surviving above-ground features. The equipment that used to run and maintain the Piccadilly fountain is also located in an underground vault here.

Secondly, and visited on the 2010 Sub Brit Manchester weekend, the toilets in Cathedral Arches are in a derelict condition deep under the Cathedral forecourt. These have not been accessed with permission since the 2010 trip (what did you all do?), but there are hopes that a more enlightened chaplaincy will allow trips in the future.

Down the pan

Lastly, and well worth a look if you are in the town centre, the award-winning Lass O'Gowrie pub hosts 'Manchester's oldest Pissotière', a wall of tiling raised thirty feet above the River Medlock. This would have had a precarious wooden structure with no privacy and a simple hole in the floor, with any 'deposits' going straight into the river below.

A blue plaque proudly states the Pissotière was last used in 1896..... I'm not so sure.

All photos Phil Catling from www.tunnelinspector.com

Subterranea Britannica

Notice of Annual General Meeting 2020

The AGM will be held on Saturday 25 April 2020, commencing at 10.00am at London Metropolitan University *(new venue**)*, **in association with the Spring Meeting.**

Attendance is open to all current members of Subterranea Britannica.

Documents for the AGM will be available on our website at *www.subbrit.org.uk* at least 28 days in advance of the meeting. An email will be sent to advise this. Documents will be sent to those members who have registered to receive them by post.

Minutes of the AGM 2019 were printed in *Subterranea* Issue 51, August 2019.

*** ***Please note new venue*** ***

London Metropolitan University, Lecture Theatre BPLG-02, Tower Building, 166-220 Holloway Road, London N7 8DB.

Enter via Tower Reception. Five minutes' walk from Holloway Road tube station on the Piccadilly line; two stops from King's Cross St Pancras

Object 1180

Cold War Command Centre in Moldova

Simon Raffeiner

The first cylinder which housed the command centre

I'm sitting in Chişinău with Sergei, the landlord of our apartment, and we're talking about our travel plans. Where we are going to over the next few days, he asks. To the northwest, up to Soroca, I reply. A round trip with the rental car. He wants to know what interests us in his country after all. A bit of everything, I say, landscapes, culture, people. History, the remnants of the Soviet Union and such.

Suddenly Sergei becomes quiet, almost casts a few glances left and right, as if what will follow is a big secret, and finally says: "There is this … bunker. In a forest, a few hours from here."

I nod and look at him knowingly. We understand each other.

MADness

One of the most important elements of nuclear warfare isn't the number or the strength of your nuclear warheads, but the maintenance of the so-called 'second-strike capability'. Each side must always assume that they cannot completely destroy the enemy with the first strike and have to expect a counter-strike which destroys at least a large part of their own territory. The English term for this is Mutually Assured Destruction (MAD).

Ensuring second-strike capability includes not only keeping the location of your fixed launch sites as secret as possible and using mobile launchers (like trucks or submarines), but also securing the chain of command in the event of the destruction of your large cities. In the United States, the President would unleash the counter-strike via radio signal from Air Force One, while the Soviet Union has traditionally relied on huge bunkers.

The territory of the Soviet Union was many times larger than that of the United States of America, so they had to build a whole network of bunkers to make sure their leaders would never be far from an alternate command centre.

Even though the Cold War had already cooled down during the 1970s, construction of several of these alternate command facilities began in 1985. Of these, Object 1161 on the Polish border in Belarus and Object 1180 in a forest in today's Republic of Moldova are known.

Looking down into the first cylinder. The cylinder is 60 metres deep but is now largely flooded

The external stairways have largely rotted or fallen away and are unusable

These are giant metal cylinders each with a diameter of about 36 metres and a height of up to 60 metres, which were embedded in correspondingly large shafts in the ground. The metal cylinders are hydraulically mounted at the bottom and could move in the shafts similar to an earthquake-proof building if a nuclear warhead was to detonate nearby.

Rooms and corridors have been stripped of anything of value

This was a common construction back then, and was also used for the command centres of the fixed launch sites. Construction of the facility in Belarus alone is said to have cost about 32 million Soviet roubles until 1990, somewhere between 50 and 100 million dollars. For comparison: a five-storey apartment building is said to have cost the Soviet Union about a million roubles at the same time.

Object 1161 in Belarus was finished and then abandoned after the collapse of the Soviet Union. Since there were often problems with metal thieves and other uninvited guests, the terrain was levelled and the entrances blocked with concrete.

Object 1180 in Moldova, however, was not completed; the surrounding Red Army military base was abandoned in 1991 and everything of value removed.

The other alternate command facilities are now either located in restricted military areas, are not accessible for other reasons, or their existence is unknown to the public. They are said to have been built in Russia and Azerbaijan, among other countries.

Many of the corridors lead to openings, to allow equipment to be lowered into the command centre

Looking out of one of the external openings. The shaft walls were clad with special, nuclear safety concrete. The large opening would have been sealed once equipment had been lowered in

We are not alone

The path to the Moldova complex leads over a long, unmarked forest road paved with concrete slabs. When we arrived there we ran into the first surprise: we were not alone. An old man looked at us from a dilapidated shipping container; one of his dogs had alarmed him.

I left my companion behind, walked slowly towards the container and started the negotiations in my best Russian. It did not take long though – 70 Moldovan Leu (about 3.50 euros) later we had made a new friend and could start our descent into the first cylinder undisturbed.

There is a metre-wide gap between the metal cylinder and the shaft. Just a few years ago the external staircase was still usable, but has now finally collapsed. The inspection of the lower floors is therefore only possible with appropriate equipment. According to various figures, there are a total of 12 or 13 floors.

The groundwater was formerly kept away by actively icing the surrounding soil, but it has returned and flooded the lower floors. It is estimated that up to 90 percent of the facility, especially the tunnels, are now completely submerged.

Whether the old guard should really use the plant as his personal well is probably a good question. The entire cylinder was spot-welded together from thick iron

Looking down the shaft into water

plates, while leaving openings for the supply lines. The reinforced concrete lid on the top alone has a thickness of about two metres. The shaft walls were clad with special, nuclear safety concrete.

One of the larger rooms on the outside of the cylinder

What looks like windows today is actually doors to the outside stairs or openings for the transport of building materials and equipment. If the bunker had been completed, these openings would have been closed and a camouflage and protection infrastructure erected above the bunker.

In Belarus, this was done in the form of a metal structure about eight storeys tall, which supposedly looked like a large hangar. There wouldn't have been any sunlight here.

Graffiti

Although some visitors had immortalized themselves on the walls, it was hard to believe that such a large abandoned

The many openings into the shaft would have been sealed once the command centre was completed

object could simply nestle in peace since 1991. It's probably a combination of seclusion, irrelevance and popular myth.

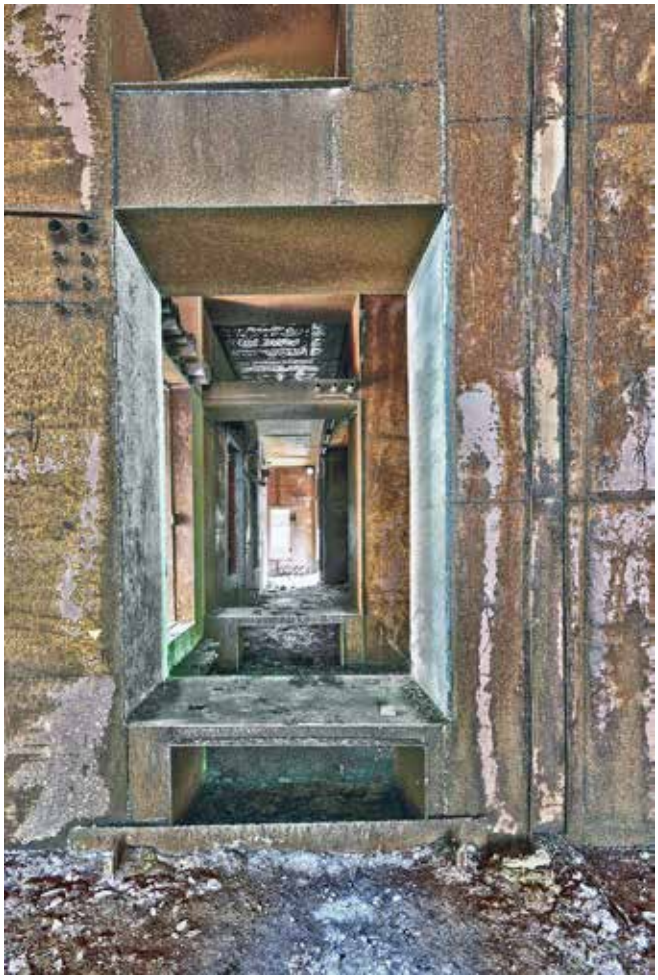
The complex is located several hours from the capital by car. There is not much of value to steal, the expensive equipment was not installed and the special steel used for the walls could only be removed with great effort. Technically, the terrain is also still a restricted military area – not everybody dares to come here.

Also no nuclear warheads were stored here. Thus, unlike in Ukraine for example, foreign countries had no interest in financially supporting the demolition, and the poor Republic of Moldova needs the money elsewhere.

The blueprint was designed for a completely self-sufficient installation with various facilities from command centres to a kitchen, a dining room and even a morgue. The life-support systems were located in the second cylinder.

The basic pattern repeats itself again and again: wide corridors lead from the outside to the centre and intersect there, the large rooms are located on the outer sides. Connections between floors are usually made on the outside wall, probably so that the floors could be sealed off individually in the case of an emergency. On the first floor of the first cylinder a total of four exits lead to the outside.

Many Soviet bunkers were planned under the assumption that self-sufficient operation would not have to be maintained for long and help would arrive from the



Internal corridor with under floor cableways

The second cylinder which contained the life support systems

The second cylinder

surface. In the command centres there were usually two teams present at all times: one operated the equipment, while the other rested on a separate floor and waited for the shift change. In case of insubordination by the active crew, the second team had to eliminate the deserters (by force if necessary) and execute their orders.

An unexpected find – bats had made themselves comfortable in one of the darker parts and were not pleased by our arrival. Time to work our way to the second metal cylinder.

What looks like a series of 'launching tubes' were actually just about one and a half metres long, empty steel tubes closed off at the other end. Maybe these should later have become the connections to the outside world. Whether the tools on the top were left behind by the construction teams in 1991 or stemmed from a later demolition attempt could not be clarified with certainty.

The descent into the second cylinder was much more difficult. The construction process had probably not progressed as far here; on one side a deep pit opened up and part of the shaft was still open. Probably the pit would have been filled and the shaft completed as soon as the building materials and equipment had been put in place.

Tunnel vision

A distinguishing feature of Object 1180 is the underground tunnel system, which connects the metal cylinders to each other and to the structures above ground. In contrast to the clearly visible metal cylinders you have to look carefully – other visitors seem to have overlooked this system or at least not reported about it.

Unfortunately there was water everywhere in the corridors. Note for next time: bring rubber boots. Farther away from the bunkers there are the ruins of the former crew quarters. Only a few were completed; the entrances were closed.

Internal corridor in the second cylinder

Someone actually still seemed to be living in one of the apartments. Never forget the first rule for Lost Places in Eastern Europe: "To foreigners it might look like an abandoned ruin, to us it's still an acceptable place to live in."

Keep out

This concrete ring probably doesn't look like it, but it has a very special feature. The inscription reads "ЫНТРАРЕ ИНТЕРЗИС", "Intrare interzis" in Moldovan/Romanian; "Entrance prohibited" in English.

The Moldovan language was written using Cyrillic letters in the Moldavian Autonomous Soviet Socialist Republic until 1989, even though the language is identical to Romanian. Since independence from the Soviet Union, Romanian has been the official language in Moldova and is written using the Latin alphabet. The Cyrillic spelling is only still being used in Transnistria.

And that's another story...

Accommodation block for the command centre personnel. One of the apartments appeared to be occupied

Spring Meeting 2020

Saturday 25 April, commencing at 10.20am

London Metropolitan University *(see below)*

The day will take the usual format, with refreshments on arrival, before the meeting starts
There are four diverse speakers for us:

Robert Stephenson, tour leader at Brompton and Kensal Green Cemeteries on 'The horror of premature burial'

Wesley Perriman, the Nuclear Curator, on the remaining bunkers and shelters at Christmas Island and the Maralinga nuclear test site

Emily Glass on her doctoral research on the mushroom-shaped bunkers of Albania

Prof Neil Hyatt FRSC, NDA, Chair of radioactive waste management, on the geology and construction of Deep Repositories for nuclear waste

The programme and speakers will be confirmed on the website and as always we are very pleased to welcome short talks or updates from Members – presentation facilities will be available. Short talks can be on any underground subject, and can last between 5 minutes and 15 minutes, so send in your suggestions

Contact Phil Catling on pcatling@subbrit.org.uk

Cost £25 to include refreshments and a buffet lunch, or £28 on the day

Booking will open in the New Year

Non-members are very welcome to attend

*** ***Please note new venue*** ***

London Metropolitan University, Lecture Theatre BPLG-02, Tower Building,

166-220 Holloway Road, London N7 8DB
Enter via Tower Reception

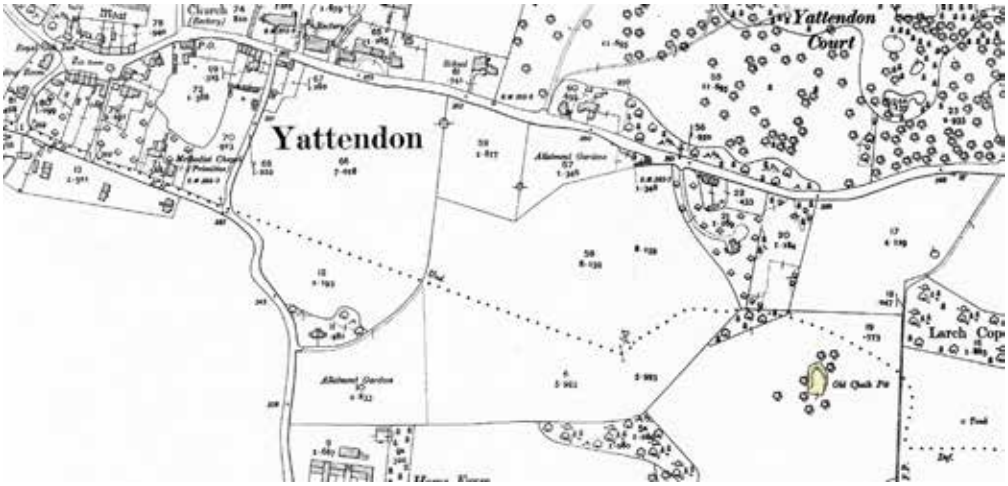
Five minutes' walk from Holloway Road tube station on the Piccadilly line; two stops from King's Cross St Pancras

Yattendon chalk mine, Berkshire

Paul W Sowan

Yattendon is a small village at NGR SU 5574 about six and a half miles northeast of Newbury in Berkshire, the underlying geology being Chalk and superficial clay and sand. The M4 motorway lies a short distance to the south.

In 1819 a chalk mine, apparently forgotten locally, was accidentally rediscovered, this event being reported in a letter from W.H. Brewer of Wantage, dated 25 October 1822, published in the *Gentleman's Magazine* as follows …



1912 1:2,500 OS map. Tunnels were dug from the side of the old quarry shown in yellow. A kiln stood to the west of the footpath shown on the map.

> I am not aware that any communication has been made in your Miscellany concerning a recent discovery of a somewhat interesting nature, made in the Parish of Yattendon, co. Berks. Some time in the year 1819, as a workman was digging for chalk to supply a lime-kiln, the ground suddenly gave way, and the man disappeared. On search being made into the cause of the accident, the entrance was at length found into an extensive cavern or excavation.
>
> The writer of this article lately visited the place, and explored, by the aid of torches, a great portion of this interesting remain of an age long since past. It consists of various passages intersecting one another, the roof formed with no contemptible skill, and supported by square pillars hewn out of the chalk, within a stratum of which the entire cavern appears to be formed. The interior is perfectly dry, and of an unascertained extent. The proprietor, who is in the habit of visiting it daily, declares that he has not yet met with a limit.
>
> I have little hesitation in attributing the formation of this souterrain to the aborigines of the island, and in classing it with those caverns of a somewhat similar nature, discovered in different parts of the country, and which have been pronounced, almost with the common consent of antiquaries, the dwellings or hiding-places of the Britons.
>
> A singular circumstance attached to the place is, that no tradition of its existence has been preserved among the inhabitants of the parish, although, by a date found within it would appear to have been visited in the early part of the 17th century.

A footnote adds …

> As a proof that no tradition of the place had been preserved, it may be remarked that no notice is taken of its existence in the answers of the Rev. George Bellas, Rector of Yattendon, to the Berkshire Queries proposed by the Rev. Edward Rowe Mores in the year 1759.

It's a chalk mine!

This 'mysterious prehistoric cavern', as described, was almost certainly a typical pillar-and-stall chalk mine, most probably made to extract suitably sized lumps of chalk (around six to eight or more inches) for 'burning' in the kiln mentioned. Chalk within two metres or so below the surface, in southeast England, is usually very much fragmented as a result of alternating freezing and thawing of the moist ground during the Ice Age.

Small chalk was unsatisfactory feedstock in a lime kiln as it impedes air flow through the charge, so was commonly screened out and rejected. How it was that the proprietor who evidently lived nearby visited daily (and why) is a matter for speculation. Brewer, in common with most antiquarians of his time, probably had little knowledge of practical or technical matters, and probably grossly overestimated the extent of the mine and its age. He was living at a time when all shafts were 'bottomless', and all tunnels ran for' miles' to noteworthy places (in Surrey, to Hampton Court), and were 'made by the Romans or earlier'.

Brewer's fanciful interpretation of the site resembles the 1890s description of the Chislehurst 'Caves' and their supposed druid, Roman and Saxon creators in southeast London, entirely lacking in any archaeological dating evidence. Nothing further has been discovered about Brewer, except that the death aged 96 of a Mr Brewer is noted in a later issue of the *Gentleman's Magazine.*

If the kiln was still working in 1819, it presumably burned large chalk from a nearby alternative source, either tunneled from an open pit or perhaps raised by windlass from a shaft. Contemporary maps indicate several small pits near the village, so there may be other small mines nearby. Sadly, Brewer makes no mention of the retrieval of the disappeared workman.

Blocked entrance to a chalk mine at Yattendon

Further historical details

In 1839 an anonymously authored history of Newbury and its surroundings was published containing further information. This records that …

> By the road side as you go from Yattendon to Pangbourne, and near the kiln, is a small well, called by the cottagers the miraculous well, because it is always quite full and never runs over; and in the ground opposite the rectory is a very deep well; it is said that just before you get to the water there is an excavation, and which was probably made in troublesome times to hide valuable things.
>
> Some years ago as a team was ploughing in a field near Yattendon kiln, the ground gave way and some large chalk mines were discovered, which appeared to have been made many previous centuries. We [exactly who is not stated in the book] investigated these mines, and as they are now closed up, we shall give a description of them.
>
> The entrance to the mine appeared to have been out of a pit near the kiln, and the interior was dug out in the most ingenious and workman-like manner; it extended under ground to a great distance, and was divided into large rooms, with pillars of chalk left as a support between the rooms, the whole had a most wonderful and grand effect. From what we could judge of the quantity of chalk taken out, the excavation must have been in progress for several centuries.
>
> It appears to have been visited or used about the year 1700, as there were several initials and dates of about that period cut in the chalk; but it is very extraordinary that none of the present inhabitants seemed to have been aware of the existence of these subterraneous rooms, although some of them must have known persons who might have remembered that period. This kiln is thought to be the oldest in this part of the country.

Visit some thirty years ago

It was my good fortune to visit this mine with the late Harry Pearman in or about 1990, entry being made via a steep muddy slope from a crown hole collapse. The tunnels are around three or four metres below the ground. And my impression was of a typical small chalk mine, the original entrance to which was hidden underground by a roof fall.

We did indeed find another but smaller chalk tunnel or drift entrance from an open chalk pit not far away. This appears to have been used as a fruit store. In 1929 J.E. Smith-Masters' booklet records a few more details …

> The kiln is on the boundary line of the parishes of Yattendon and Frilsham, some 200 yards south of the Pangbourne Road. From its proximity to the caves it may perhaps be assumed that the excavations of chalk were made for the burning of lime. It has long since been disused. Some half-mile Southeast are other caves on the Yattendon (Frilsham) House Estate, which are still in use for storing fruit.

Harry Pearman made several visits, and published notes on the mine in several contributions to the publications of the Chelsea Spelaeological Society and the Kent Underground Research Group. These will be summarized in a future issue of *Subterranea*.

Sources

ANON, 1839, *The history and antiquities of Newbury and its environs, including twenty-eight parishes, situate in the County of Berks: also a catalogue of plants found in the neighbourhood. Speenhamland: printed and published by Hall and March:* fp folded map + xii + 340pp + plates [Yattendon chalk mines, kiln, and wells are described in page 230]

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SMITH-MASTERS, John Ernest, 1929, *Yattendon and its church, with records of the Manor and the village from the 10th century to the present day*. Cornwall Press Ltd: viii + 80pp.

Protected Bunker Construction

Nick Gould

Sub Brit member Nick Gould recently hosted a Cold War exercise in the bunker he has constructed in the grounds of his home in Somerset. Before Eugene Sully gives a first-hand description of how the day itself went, Nick tells us the background and construction details of this fascinating and unusual structure.

Preparation of the base slabs for the basement

Background

I have had an interest in protected accommodation since being involved in emergency planning during the 1980s. Having been involved in the upgrade of several emergency centres to a 'Tom Butler' design, I had an understanding of the requirements for the design of protected buildings.

In later years, we had owned a number of buildings with cellars and basements which gave us more knowledge of their design and construction. When the opportunity recently arose to construct a new building, this provided the opportunity to create a purpose-built basement with the inclusion of some protected accommodation features.

Design

The design evolved over time as did the scale of the basement. The reference book *Domestic Nuclear Shelters – Technical Guidance* (HMSO 1982) is a good source of construction inspiration; the desire was to improve upon the elements within that book. The space needed to be flexible enough to have a domestic / recreational / ancillary function but with the added capability of performing as protected accommodation.

The original design was to use corrugated iron as the formwork for the structure and create an arched roofed basement. Due to the increase in size and the weights involved, the design changed to a more substantially reinforced structure. Once the overall design was established, I submitted it to Lunor in Switzerland, who provided advice in terms of blast protection and design features. They indicated the location and number of blast valves required, as well as airlock and blast door design. If in doubt, my approach was to over-engineer.

The basement design was undertaken by ourselves including all engineering and design features. We employed our own Building Control Inspector who monitored and approved the works as they progressed.

Construction was undertaken by our own staff and contractors from Poland; the Polish contractors were well versed in the use and application of concrete.

Excavation, Foundations and Drainage

It took about three weeks to undertake the excavation; due to being on the Somerset Levels, we hit water early on and this had to be pumped away. We also hit seams of bed rock – the greyish blue lias (a limestone layered with mudstone) that is prevalent within the locality. We crushed this on site and used it as hardcore. Spoil was taken away and spread within fields that we owned; topsoil was set aside for future use.

The whole foundation is a reinforced concrete slab. Layers of A393 mesh were wired and welded to form the reinforcement. Concrete to a RC45 specification was poured (the code is a measure of strength – 45N/mm2 after 28 days). The slab in total is a metre thick to allow for the placement of additional buildings above the basement. The site was shrouded with scaffolding and ex-army tarpaulins to allow for all-weather working.

Formation of the reinforced slab using A393 Mesh

Wall Construction

The wall construction was achieved as follows:

Inner concrete hollow block with 20mm rebar inset connecting from the floor slab.

Cavity, with A393 mesh sheets wired and connecting to the hollow block and 20mm rebar.

Outer concrete hollow block with 20mm rebar inset connecting from the floor slab.

Concrete for the hollow blocks was mixed on site, to a RC45 mix and applied by hand. Once this had set, the cavity was filled with RC45 from a pump. This had to be done in stages due to volume and pressure.

The floor slab and external walls were all tanked using a tanking solution. This consisted of the application of four layers of RIW Liquid Asphaltic Composition. We doubled the level of application to provide additional layers of protection. RIW is a specialist waterproofing company based in Slough, whose initials pleasingly stand for *Remember It's Waterproof* from an advertising slogan of 1921.

Reinforced Slab after pouring
(note rebar rods to connect to wall structure)

Ad hoc shrouds to enable all-weather working

Drainage

Whilst the tanking provides a high level of protection, the main priority was to move water away from the building as much as possible. This was achieved as follows:

- Drainage channels sunk below the floor slab and to the side
- Insertion of deep French drains
- Construction of sumps both within and outside the structure
- The sumps connect to underground harvesting tanks for water storage
- Whilst there is some gravity feed to sumps and tanks, there are also pumps which take away surplus water to surface ditches and drains

Manhole steps were constructed within the sumps to allow for inspection.

Roof Slab

This was achieved using metal decking. Calculations were undertaken to ensure that the decking has the capacity for the load proposed. Then three layers of A393 mesh were welded to the decking and the rebar of the walls. In addition, every 2 metres a suitably sized RSJ was affixed to the structure;

shuttering was then put in place. The roof slab was then poured – again with pumped RC45 concrete. The roof slab depth varies between ½ metre and a metre in parts.

Metal decking insitu

External Services and Security

Outer doors were purchased from eBay – these were originally sub-station security doors from a redundant site. We then cut and welded these to form outer doors. Stairs were constructed using hollow block and rebar. Shuttering was formed and these were cast in situ.

Blast Doors were sourced from Lunor in Switzerland and were imported direct. These are the PT3 blast doors. They consist of a metal frame which is then shuttered and cast in situ. Openings for the blast valves were cast in situ.

For resilience, there are duplicate air intakes and exhausts at each end of the building. Again, this was over-engineered to provide resilience in the event of the failure of one of the systems. The air intakes also act as emergency escape hatches from the facility.

An ex-MOD generator was obtained for standby power purposes. This was delivered to the site and then winched in place within the basement. The plant room was constructed with the generator in situ.

Internal Fittings and Services

There is mechanical ventilation, as when shut down the basement is a positive-pressure environment. The CBRN (Chemical, Biological, Radiological and Nuclear) ventilation system is the VA150 type as used in Swiss protected accommodation. An archive-quality dehumidification system was installed to allow the basement to be utilised for archive purposes and to ensure the necessary levels of humidity. For sump purposes, as well as electric pumps there are manual gusher whale type pumps.

There is a strong room and we sourced a Chubb strong-room door with combination lock from a redundant nightclub (which had originally come from a local bank). We refurbished this and had it installed.

Communications Room with UHF & VHF antenna feeds leading to strong room

The basement has a number of data / telephone sockets. These terminate at the switch room, where the main cabinet is installed in a Faraday cage. There are also a number of feeds for VHF & UHF antenna; a feed for a PDRM82F is also provided. We utilised Racal 2000 PTC414 handsets, which have NEMP (Nuclear Electro-Magnetic Protection) for the internal intercom system.

PT3 Blast Door being cast insitu

PT3 Blast Door completed

Main Operations Room - Walls painted with tanking solution

Main Operations Room – Completed

Main Operations Room - Walls dry lined

Main Operations Room-Dry lined and PT3 blast door at rear

Entrance steps - Cast in situ

Data cabling being installed in basement

Entrance lobby completed

Emergency exit completed with gas tight door

Completed airlock of PT3 blast doors & PTC414 hardened telephones

Generator Room under construction

Completed rest area of basement

The emergency services have utilised it for exercise purposes. It was a practical lesson, as due to the shielding that the metal decking provides, airwave and other communication systems do not work within the basement unless they are fed through the basement's own switch.

A further Cold War exercise is planned for 2020 where Sub Brit members will be very welcome to visit, especially those unable to make the recent date.

Generator room completed - with air intakes and exhaust

Next Phase

The basement structure is sufficiently complete to be operational. The next stage is the completion of the surface buildings. As a construction exercise, it was an experience in the use of concrete and the utilisation of cost-effective building methods.

Whilst purely a domestic basement, the bunker does provide versatile facilities and is used on a regular basis.

The bunker is nearing completion

"For Exercise, For Exercise" - Private Bunker Visit

Eugene Sully

EXERCISE-EXERCISE

Press Release

DISTRICT COUNCIL CALLS FOR VOLUNTEERS

The Rural District Council, in conjunction with the County Council, is launching a campaign to recruit additional Civil Protection Community Advisers. Currently around 50% of Town and Parish Councils have formed their own Community Emergency Teams. These teams are trained in a variety of skills to help their communities in time of emergency.

It may have been several decades since the fall of the Berlin Wall and the Iron Curtain came down, but civil unrest, weather events, power failures and other disasters can still happen. Of course Civil Defence as it was called was a major part of managing should these events have occurred; they were also ever ready should the maroons and sirens go off in the event of nuclear strikes against the UK.

Civil Defence

Well rehearsed in Civil Defence and with the intention to have a more unusual garden feature, Sub Brit member Nick Gould decided that it would be useful to build down and have a bunker retreat at his home nestled in the village of Long Sutton near Langport in Somerset. This was to be the setting for the bunker exercise on 12 October 2019 which was to make a fascinating and fun day for 23 members of Subterranea Britannica.

Rather than have a simple tour of the bunker, Nick devised a day-long exercise based in the 1980s so we could all experience how a local authority bunker might actually have worked. Attendees were briefed on *Exercise Grapple* before the event with contemporary training documents and guides. These were augmented by realistic 'injects' of events as they unravelled – both on the international stage and at a local level.

The entrance to the bunker

On the day of the exercise, once parked up, we were invited down into the bunker, based on the designs by Tom Butler & Co. We entered through an open – but very new and imposing – steel and concrete door by Lunor G Kull who make the doors for the Swiss bunkers. Once through the door we registered at the guard room next to where decontamination would be and next to the Elsan toilets (though at Nick's request we used surface facilities during the exercise).

The large steel and concrete door. On the plate it reads 'Lunor G Kull AG Fabrikation. . . . .Zurich'

Operations Room

We then walked into a sizeable operations room where the exercise was to take place. It was beautifully laid out with tables just like I had at secondary school and with village community centre plastic chairs. Lots of other period accessories were in place – in and out

trays, pads of paper and, on a stand-up board, A3 sheets with “Fire”, “Police”, “Regional Health Authority” etc printed on the top of each one.

Screened-off from the main Liaison Officers’ Room was the Control Room where key decisions would be made and beyond this the communications room, equipped with period phone and radios.

The Radio messages and other messages are filtered by the message clerk.

Liaison Officers’ Room

While waiting for the exercise to begin, we toured the rest of the bunker which included a delightful kitchen with a Burco urn, original Belling stove and period (in style, not date) biscuits. There were also a few storage areas and a plant room with emergency generator and ventilation plant.

The emergency generator complete with brick bund

Authenticity was the order of the day and after being shown round, we were put in our groups to be told what the state of affairs was now the current situation had started to deteriorate. A couple of attendees didn’t materialise so adjustments to the staffing had to be made; this however is highly likely to have happened in real life and added to the realism.

Agent Orange

We had been given a comprehensive set of notes prior to the exercise and these included stats – from the mid-80s – of resources that would be expected to be available, and effects of blasts, and other training material. In amongst this, we had been sent notes about what had been happening between us – the “Blue Alliance” – and the enemy, who were codenamed “Orange”. Disputes in the Straits of Hormuz had led to growing tensions and the Orange Forces had invaded ‘Blue’ Alliance territory. Closer to home, we were in Lambinfield Rural District Council with their logo a lamb in a shield.

As well as the Sub Brit players, Nick had persuaded former civil defence officer Simon Hill to be controller for the day and with his experience was very good at briefing us, all the while remaining professional to encourage us to make decisions rather than telling us what to do. We also benefited by having ex-policeman Shaun Bradley as Police Liaison Officer and Anthony Rockett as our Bunker Facilities Manager.

My Role

In the morning I was sitting on the emergency services table and was in charge of police staffing; next to me were Fire, Ambulance and the Police Liaison Officers. Once the first message, about a strike at Yeovil, came in, while we were working out and writing down how many staff and units we may have, along comes another message about a gathering of ‘self evacuees’ on a roundabout and could we send some police down to deal with them.

I decided it would be useful to check the map at the end of the room for what other towns and villages we may need to pull resources from and also became aware of how much of an artery the A303 is, as at this time, congestion was building up.

Civil Disobedience

From then on it became very intense with thefts of sandbags from the council offices, shops being looted, gas cylinders needing escorts to prevent their being hijacked, and still everyday logistics like dairy and farm produce which was not able to be transported as the people who would be doing those jobs were likely stuck or had left the area.

One of the biggest issues was a lorry on fire on a bridge which had pretty much cut off the area. This meant that the emergency services, but also, logistics, people, and transport of goods could not take place. In addition, cars were being abandoned, compounding the problem.

In the scenario, all of this disorder was occurring before any nuclear strike – illustrating how quickly a rural area might get overwhelmed by those evacuating from urban areas. No matter how well prepared a village might be, their facilities could easily get swamped by incomers.

Other groups in the Liaison Officers’ Room were Welfare

How can we solve the logistics issues now the A303 and the bridge are both blocked?

(eg WRVS, Food, Homelessness); Works and Technical (Manpower, Transport, Requisitioning); and Group Liaison Officers who interfaced between parishes below and Group Control above. Many incidents and requests involved multiple agencies and so communication within the Control Centre was as crucial as externally.

Crumbling Morale

We took a break for lunch and sampled a Parish Council Emergency Feeding Centre with house rules demanding that we help with serving and clearing and refrain from swearing. This was a very fun affair in an undercover stable with some bunting up and plenty of stew cooked on site with a ration of bottled water. This was followed by dessert of apple crumble – a war exercise still has its luxuries. Nick and his wife Lynne, we suspect, served us a better meal than might have been strictly realistic.

Emergency Feeding Centre, all welcome, except locals. Help by serving and cleaning. Do not waste food

After lunch we were able to see a small Anderson-sized World War II shelter in the garden which was in a nice state of preservation. We then all changed roles to

A well earned lunch. Stew and Potatoes followed by Crumble

maximise the experiences that everyone had. For myself, I became a Radio Operator in the Communications Room and the link with the outside world.

Stand By One

Our messages were largely coming in by radio, although the phone occasionally rang and we even got

Anderson-style shelter nicely hidden with greenery and some pleasant steps

a few by dispatch rider. The radios were in this case a couple of old citizen-band radios with Nick outside at ground level being very official playing the roles of the likes of Sparkford, Ilchester, Wincanton and Sherborne Councils passing on updates and requests for resources and information. For non-locals, decoding the station calling was sometimes a major challenge (whoever knew a nearby village is called Curry Rivel?).

Dealing with very realistic interference and also trying to take and convey messages is surprisingly difficult. Even as a Ham and with some limited flying credentials, I will admit RT is not my best skill as I get in a muddle and also my writing is not that great; but these were important messages and lives were at stake, so I felt accuracy was more important than speed – the problems would still be there in five minutes.

Many times I would need to ask for information to be repeated or indeed, I say "Stand by" or worse still, after a message was passed, my not acknowledging it for maybe a minute, until I had written it down. Of course as this was happening, occasionally one or two messages came in for me to send back!

Communicating and writing can be surprisingly difficult when actually having to think too

It's only an exercise...

It's probably the hardest I've had to work in years, and every time the radio appeared to go down, I'm getting involved enough to think maybe a nuclear strike has occurred or a sky burst has caused EMP to take out comms. …. Then I remembered, it's only an exercise!! Time for tea and biscuits I think.

The messages were interesting – I had never used pads with duplication on them and had to be shown how to put the card under the next sheet, and the blue carbon sheet in between for taking notes. As for the radio messages,

Liaison Officers' Room

as they came in, it was important to log the time and who it was from, but then what happens when there is a follow-up to the message? Turns out the response is just written on the back, and timed.

Emergency Committee

In the background the messages were being managed, collated and passed on by the message clerks who were doing a great job of filtering the messages and condensing the information from the different groups represented. Most new messages routed via the Controller and the Emergency Committee who had to try and prioritise them and then approve major interventions. Sample question, 'Where shall we send all the evacuees?' – answer: 'Use the County Showground where there should be at least some infrastructure'.

What perhaps was most useful was realising how limited resources are and how the only information one has is that of the messages coming in. How initially dealing with a welfare issue may require assistance from one of the emergency services, but then, later, a fire or a gathering may then not have a unit available to deal with it.

This is how, as a team, people try to gain a holistic view of what is happening and co-operate and start planning how best to manage. Another lesson is that without explicit briefings for the staff involved, many participants would have a very incomplete picture of unfolding events.

The BT carrier control point WB1401

Attack Warning Red

Once the exercise had finished, there was a question and answer session and a demonstration of some alerting

methods. We were told about the carrier control – the speaker on the telephone line that clicks every second or so, but if there was an attack, a warbling tone would be sounded.

Nick then demonstrated the hand siren, suggesting that we visitors also have a go. On three blows of a whistle Anthony launched three maroons to indicate approaching Fallout. Hopefully Nick still has good relations with his neighbours!

Demonstration of a Maroon (one of three) to warn of fallout

Demonstrating the hand siren with the entrance to the bunker behind

As an exercise in 'experimental archaeology' Nick had also constructed an emergency domestic inner refuge, along the lines of the advice in the Protect and Survive pamphlet. This consisted of a surface fallout room, with windows blocked by sandbags. Within this was an 'inner refuge' of a large angled wooden panel, loaded with sandbags. The shelter had taken Anthony about three days to construct and he estimated around two tonnes of sand and soil had been used to fill the sandbags. Outside the room but within the fallout room were the toilet arrangements: a wooden chair

Which wine would you like to choose?

Simon and Nick standing under the vaulted ceiling of the cellar

with the seat cut away, positioned over a plastic bucket. It was an enormous contrast to the luxury in which we had spent the day and was a stark reminder of what would have faced the vast majority of the country's population in the event of nuclear attack.

Sandbags. Photo Clive Penfold

Winding Down

The final surprise of the day was a visit to the wine cellar under Nick's own house which dates from Georgian times. It has an unusual and fine vaulted ceiling. In it was a very comprehensive collection of wines, a small bar and even a well (or possibly drainage sump).

Over a glass of wine we learnt that the cellar was used to house German prisoners in World War II and although the original secure doors had been removed, two of the side rooms now had similar barred doors in place.

Overall the day was extremely useful and fun, but as well as the usual working in teams and focussing, it did bring home the challenges for the authorities and services in a war or disaster. It is perhaps a shame that the traditional Civil Defence infrastructure is largely gone as it is associated with 'planning for war'. Having more people educated and trained in how to work in these situations would enable us to tackle emergencies and disasters in a much more efficient and effective manner.

Many thanks

Thanks are due to Nick Gould and his team for the immaculate planning and the orchestration of a very informative and thought-provoking day. The settlements along the A303 in the area will never seem the same again.

All photos by the author.

SubBrit Reading 2019

Phil Catling

In October, a number of SubBrit members and interested members of the general public converged on the University of Reading, Whiteknights campus for the Autumn day meeting. Usually held in South Kensington at the UCL Royal School of Mines, changes to the availability of the conference room during term time have meant a move out to the suburbs. The University Palmer building is a 1960s built location and perfect for the day meeting, with excellent communications, facilities, refreshments and even a Nuclear bunker onsite. The provision of teabags from God's own county rather than fruity or Earl Grey versions was particularly commented on.

Photo Phil Catling

After registration with Linda, and a welcome brew, attendees made their way to the intimate and friendly lecture theatre. After welcome and housekeeping, details of the day were given, including social media details and the official hashtag of our day meetings #SBMeet so attendees could share photos and comments throughout the day. First up was our Chair, Martin Dixon, welcoming everyone and talking about local underground sites before giving an overview of SubBrit trips and activity since the Spring meeting. Responding to online comments about the lack of local underground interest, Martin gave examples of bunkers, mines, and nearby tunnels. Also, Martin took the opportunity to highlight the recent display at the London Transport Museum of remains from the first ever spiral escalator from London Underground. The inclusion of RSG 6's starring role in CND literature also raised a few smiles.

First listed speaker of the day was Adrian Armishaw, with an extended version of his excellent recent SubT article on the Sutton Coldfield air raid shelter discoveries. Peppered with lots of behind the scenes and detail images, Ade spoke about the fixtures and fittings of the two shelters found under a patio, with diversions into the possible reasons for such a large and well fitted shelter

Martin Dixon opened the meeting and talked about local underground sites. Photo Phil Catling

in an unexpected area. The discovery that features of shelter one were designed and made in Germany led to an interesting series of original 1930s advertising and publicity shots. These showed similar shelters built as examples for sales brochures in Germany. Questions from the audience came thick and fast with recommendations for an official SubBrit visit top of the list.

After Ade, there was time for a much threatened but rarely seen happening – the day was running ahead of schedule. I pulled out the emergency slideshow and talk, written years ago 'just in case'. Focussing on an underground area not often looked at by SubBrit, the talk covered the discovery in the 1950s of human remains in Dowel Cave, Derbyshire. The remains of 'Fred and Ginger' were buried missing the lower six inches of their legs and feet, removed after death but before inhumation. Along with eight other burials over a span of hundreds of years, Fred and Ginger show a pattern of return for burial by a group or tribe of their leaders or 'kings and queens'. The cave is a Scheduled monument but easy to visit, and an interesting feature is the survival of whitewash markings from the original 1950s archaeological dig on the cave walls. The humid atmosphere means the whitewash is still wet and liable to mark a visitor's overalls! A number of competing theories regarding the removal of the skeletons' feet were put forward, including 'ritual', 'magic' and 'religion' all posited by reputable archaeologists. We heard the favoured theory, published by the archaeologist and illustrator who excavated the cave in the 1950s, Don Bramwell. Don put forward the idea that the two bodies were 'shortened' to fit the available space. The skeletons and interpretation are on display in Stockport Museum and can be seen if visiting. As Fred and Ginger have now had their moment of SubBrit glory, a new back-up slide show will need writing before the Spring day meeting in April.

Excavated tunnel, part of Operation Gold

After a short break we moved on to our second speaker, Professor Patrick Major of the University of Reading. Kindly coming in on his day off, Professor Major gave an excellent overview of underground Berlin from WWII and through the Cold War, mentioning many of the sites visited by SubBrit on the Berlin visit earlier in the year. Covering a bewildering array of bunkers, brewhouses, flak towers, and bunkers, highlights of the talk included ghost stations on the Ubahn throughout the partition of Berlin by the Wall, and detailed information on escape tunnels from the East to the West. An engaging and fun speaker, Professor Major held the audience rapt as he spoke on Operation Gold, a clandestine tunnel 'tapping' the main telephone cables from East Berlin to Moscow. The tunnel was revealed to the KGB by British moles almost before completion but allowed to continue as a smokescreen before being 'accidentally' discovered by building works.

Before lunch it was time for the first of our Members contributions, an excellent short talk on the underground tunnels and facilities of Graz, Austria's Schlossberg mountain. Michael Higgins raised a few eyebrows by including slides of trams travelling above ground before diving deep into the mountain with some excellent photos.

Reading Regional War Room in 2001. Photo Nick Catford

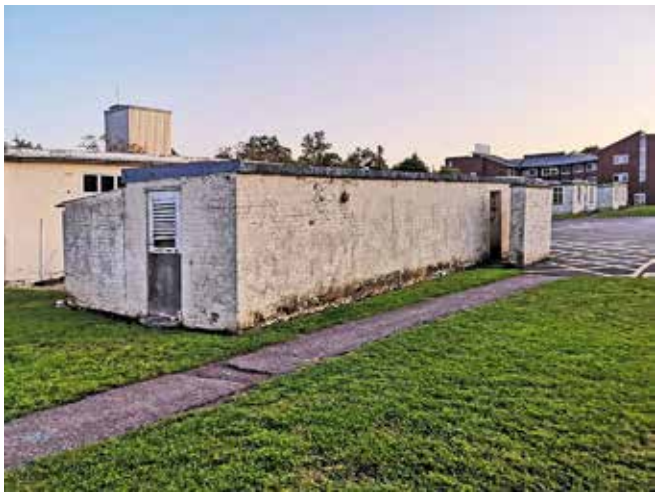
Reading Regional War Room in 2019. The fuel tank seen in the picture above has been removed. Photo Phil Catling

At lunch a number of attendees headed across campus to see the external features of the early Cold War regional war room. Built in the 1950s, the bunker was one of a number of Civil Defence sites across the country. Regional government for the surrounding counties and the Isle of Wight would have been directed from here on the loss of London and centralised control. Unfortunately we couldn't arrange access to the bunker which is currently unused but protected by Grade 2 listing. Battered and bruised, the bunker is obviously being visited regularly by local youths and had a variety of access points spotted by SubBrit members. Of course, no access was attempted, although the door handles were tried a few times, just in case.

At least three brick built surface air-raid shelters survive on the campus. Photo Adrian Armishaw

As a dispersed site for central Government during WWII, the Whiteknights campus has a number of surviving buildings of interest, including prefab offices covering a large area and at least three brick built surface air-raid shelters. Each shelter was designed and built with added bicycle storage at the side. The recent removal of one of these lean-to structures has revealed original WWII whitewash signage warning employees the Ministry of Works was not responsible for thefts from unattended bicycles.

Original WWII signage. Photo Phil Catling



Surface air-raid shelter with a bicycle shed added to the far side. In the background prefab offices are seen. Photo Phil Catling

Rushing back for the afternoon session we prepped for our third listed speaker, and a return to more traditional SubBrit topics after Neolithic burial sites. Chris Grey spoke on the difficulties of construction and loss of life of two Victorian railway tunnels, the wonderful brick extravagance of Bramhope and the more traditional Hose (aka Clawson) tunnel.

With great photos of the interior and portals of both tunnels, Chris went into detail about the huge portal of the Bramhope; crenelated and turreted, the portal had rooms and fireplaces, with railway workers and tunnel staff living there for some years. The Gothic entrance is replicated in miniature by the nearby Otley memorial to 24 miners and workers lost during construction. The Clawson or Hose tunnel was not as pretty, but much easier to walk through as it no longer has passing trains. A number of lives were lost during construction here too.

Our keynote speaker was making his second appearance at a SubBrit day meeting, after being co-opted to speak in the Spring about the Witch Mark discoveries at Creswell Crags during SubBrit's visit in 2018. Ed Waters is an internationally respected caver and mine explorer and spends many hours underground with the Mendip Caving Group along with partner and fellow SubBrit member Hayley.

Ed spoke about the almost decade-long quest to forge a through route from surface to base of the caves and

Photo Phil Catling

mines of Sandford Hill in the Mendip range. Photos of such wonders as mine pearls, flowstone and speleotherms found during the search, were included. With excellent photos and 3D plans showing the connecting shafts and adits, Ed told the story of the search for a large drop shaft – the Sandford Gulf – described in the 18th century exploration and mining of the caves, linking Sandford Levvy, Pearl Mine and a huge number of uncharted shafts.

Our final member contribution came from Bob Clary, with two quite different short talks. Firstly he discussed a recent trip to a vast NATO bunker called Ouvrage G before finishing with a great set of images from a visit to the WWI concrete forts of Metz.

Air-raid window shutter. Photo Adrian Armishaw

With a final thank you to all the speakers and attendees, it was time to finish the day, with many people who missed the War Room bunker at lunch heading over to take photos. A pleasant find before leaving was a mint example of a WWII air-raid window shutter on one of the prefab office blocks. Recognised from a similar shutter shown in Ade's talk on the Sutton Coldfield shelters first thing that morning! As always we could not organise or arrange these twice yearly events without the hard work and support of many members, but special thanks must go to SubBrit Secretary Linda Dixon who not only found and organised the location, but wrangled guests and attendees, womanned the Subterranea stall, fixed the lighting and was, as always, refreshment and namebadge guru.

SUBTERRANEA BRITANNICA

2020 Study Weekend
Oslo, Norway

Friday 8 – Monday 11 May 2020

Our European travels in 2020 will take us to Norway, with a weekend starting and finishing in the capital, Oslo and some excursions along the way. Lars Hansson, one of our Sub Brit members based in Sweden, is doing most of the leg work, supported by Tony Radstone and Martin Dixon. The main visits will start at 14:00 on the Friday afternoon, continue all day Saturday and Sunday, with return travel on Monday. There may be optional visits on Friday morning for early arrivals. There are many public attractions in Oslo to make an extended stay worthwhile.

The focus of the weekend will be on places related to the defence of Norway and associated sites, from the thirteenth century through to World War II and the Cold War. Sites are expected to include:

- Ω In Oslo – the Metro, Akershus Fortress (medieval and a Royal Residence), telephone exchange and a German High Command WWII bunker
- Ω Hoytorp Fortress dating from c.1910
- Ω Oscarborg Fortress, dating from the 1840s, and famous for sinking a German ship in World War II
- Ω NATO Comms room inside the mountain at Gaustatoppen, Telemark
- Ω Vemork Hydroelectric power plant in Telemark – scene of the famous 'Heavy Water' raids by the Norwegian Resistance and SOE in WWII
- Ω Gaustabanen cable car, inside a mountain

Our estimate for the cost of the weekend is approximately £460, to include Friday, Saturday and Sunday nights B&B in a shared room, most meals on Saturday & Sunday, coach transport for Saturday, Sunday & Monday, entrances and guide fees, brief site notes and arrangement fees. The hotel single supplement will be about £120. Prices may vary depending on the exchange rate.

We plan to stay at the four-star **Radisson Blu hotel** in Oslo on Friday and Saturday and in Gaustablikk on Sunday (approx three hours from Oslo by coach).

You will be responsible for your own travel to and from Norway but please do not book this until you have a confirmed place. There are no visits on Monday, as we shall travel back from Gaustablikk (by coach, approx three hours) to drop people at the airport in time to catch afternoon flights (timings to be confirmed later).

Booking for the weekend will open in January on a date that will be communicated by email. A non-returnable deposit of £50 will be taken at this time. All attendees must be members of Sub Brit for insurance reasons. Members under the age of 18 must be accompanied by a parent or guardian. You will need a good level of fitness in order to participate in the weekend. General conditions for Sub Brit weekends can be found on our website.

ROC 28 Group Awards - Scotland

Martin Dixon

Deputy Group Commandant Peter Blockley presents the award to Gavin Saxby at the bunker in October. Photo James Wylie

A small team led by Sub Brit member Gavin Saxby has been restoring the Royal Observer Corps Group Headquarters bunker at Craigiebarns (Dundee) for several years. The group runs as a registered charity – 28 Group Observed.

As well as being the Group Headquarters for 28 Group, the bunker also includes the UKWMO (United Kingdom Warning and Monitoring Organisation) HQ Caledonian Sector.

We were delighted to hear that the restoration team won the ROC Association's

John Simmonds Heritage Trophy for their work. Sub Brit helped fund elements of the restoration and those who have visited the bunker will surely agree it is well deserved.

The citation for the award reads:

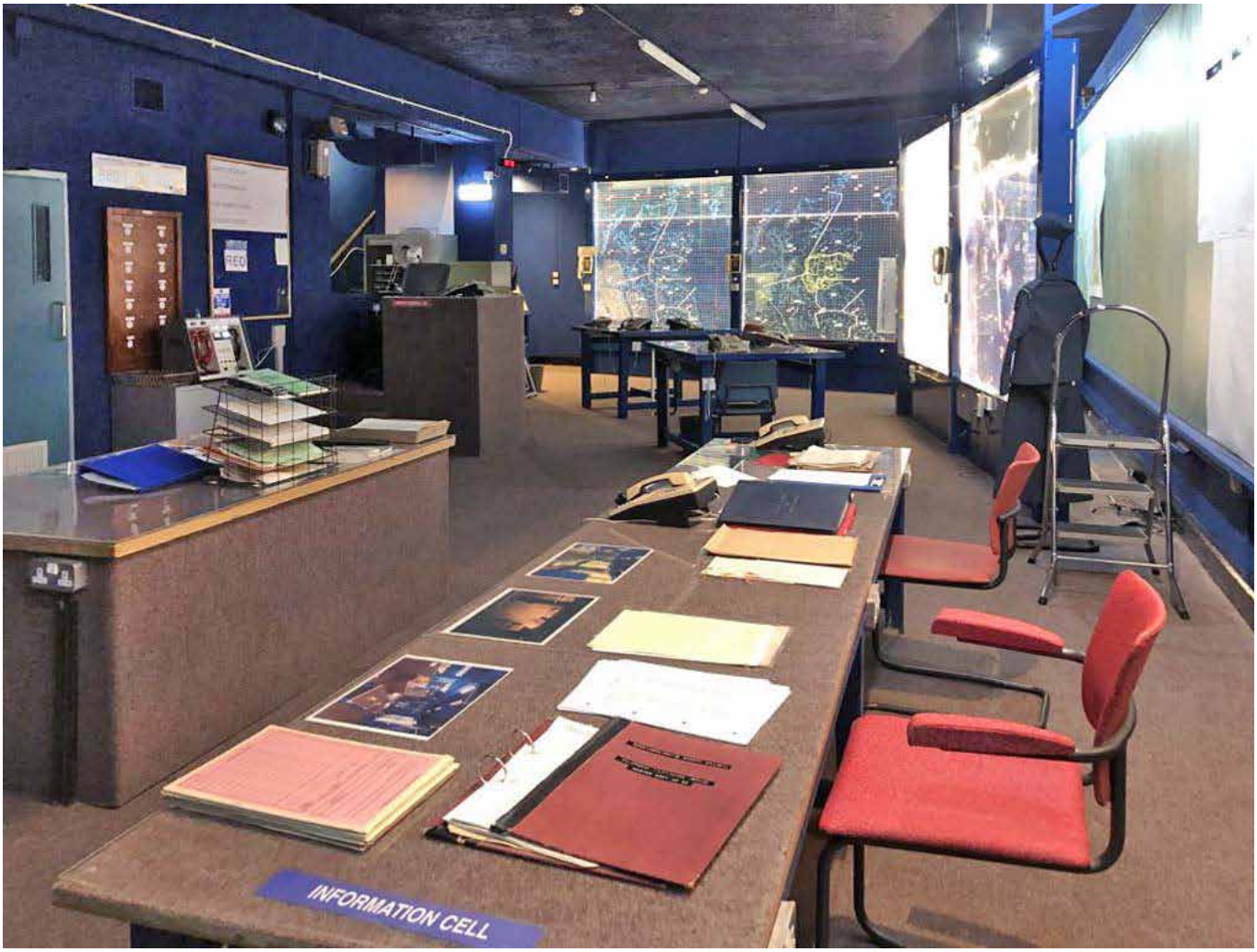
> ***Gavin Saxby and his Team***
>
> ***This award recognises the amazing work of Gavin Saxby and his Team, many of whom are Post Restorers themselves, restoring the Royal Observer Corps Headquarters, Scottish Area, encompassing the UKWMO HQ Caledonian Sector at Craigiebarns, Dundee to its former glory.***
>
> ***Despite the set-back of the devastating flood in the early years the Team persevered and restored the Underground Headquarters which bring to the public the work of the Corps in Scotland and complements the Posts which are open to the public in Scotland.***
>
> ***It is especially noted that Gavin did not serve in the Corps, but wished to preserve the heritage which he has done so successfully in the amazing restoration.***

The award – a striking golden Spitfire – was presented by Deputy Group Commandant Peter Blockley to Gavin at the bunker in October.

As well as the restoration team's award, Peter Blockley himself won an award for his work leading the 28 Group ROCA; Cheryl Stewart won another heritage award for her restoration of the Arbroath ROC post; and David Shaw also won one for his work promoting the heritage of the Corps and helping with several restoration efforts.

A great haul for the Corps in Scotland and the North of England!

Sector Operations before restoration began

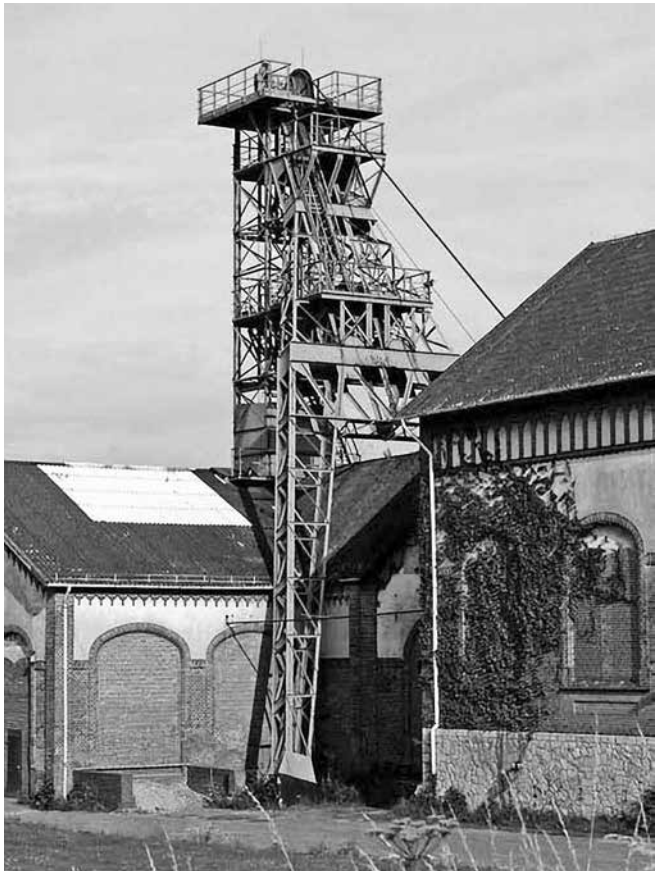


Sector Operations as it is today

Bad Salzdetfurth – A Mining Legacy

David Gordon

Bad Salzdetfurth is a small spa town south of Hannover, in the foothills of Germany's Harz mountains. As the name implies, the main industry in the town is a spa offering saltwater-based treatments for various ailments, particularly breathing problems. This type of medical treatment is popular in Germany, and can be prescribed and paid for through your health insurance.



Shaft 3 before mine closure. Photo Thomas Plessner

Salt mines

What is more surprising to the English visitor is that this is in fact a former mining town, with many remains of the recently closed salt mines still evident, including the headstocks of two shafts up on the hillside and the main processing works, which is located next to the station.

The town's salt trade began in the early middle ages, when a salt spring was discovered and exploited. As a result the town centre presents a medieval appearance, with the half-timbered houses (*Fachwerkhäuser*) typical of the area (although many of these date from the nineteenth century or later, as the town suffered from periodic fires and floods).

Beginning in the eighteenth century, the saline solution was concentrated by pumping it eight or nine times through stacks of blackthorn twigs (*Gradierwerk*), which had the twin function of removing impurities and concentrating the solution through evaporation, raising the salt content from nine to 29 percent, which permitted a major saving in fuel during the extraction process.

Shaft 2 before mine closure. Photo Thomas Plessner

Although the *Gradierwerk* process fell out of use in the mid-twentieth century, the installation has survived as part of the spa complex and saline is still pumped through the system. Visitors are encouraged to sit or exercise next to the blackthorn stacks and "breathe in the North Sea air" (although the North Sea is over a hundred miles away); a band plays at weekends.

Interest in deep mining began in 1892, with the sinking of boreholes to locate the salt and potash levels, and the first shaft, with a diameter of 16m, was sunk at the end of that decade, reaching 713m in 1899. The shaft eventually reached a depth of 918.8m in 1930. Shaft 2 was sunk in 1907 (information on this shaft is harder to come by) and Shaft 3 was begun in 1913, reaching a depth of 856.6m and being extended to 955m in 1962.

Shaft 2 before mine closure. Photo Thomas Plessner

Between 1979 and 1982 Shafts 2 and 3 were given new steel headstocks and in 1984 Shaft 3 was extended yet again to a depth of 979.1m. Potash mining stopped in

1992, but rock salt continued to be brought out until 1994, when the mine closed. Products of the mine were potash, rock salt and magnesium carbonate.

Shaft 1 and museum. Photo from Wikipedia, reproduced under creative commons licence

Headstock memorials

Shafts 1 and 3 have since been plugged with concrete, but the headstocks are still in remarkably good condition, painted green to blend in with the forest. It seems that the headstocks and mine buildings at Shaft 3 will be removed at some point, but those at Shaft 1 are being preserved as a memorial. The processing works in the town is currently in use for the production of cat litter.

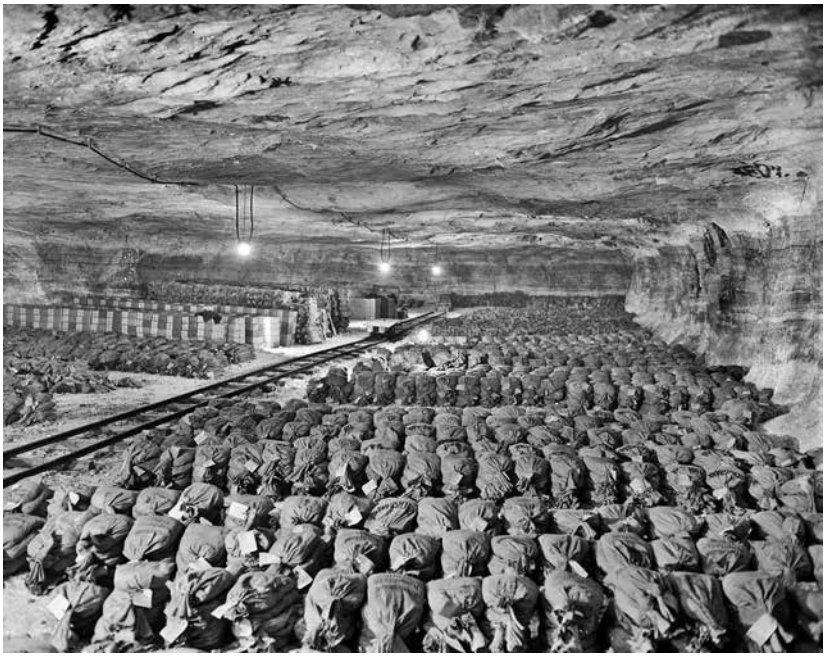
The town has realised the tourist potential of its mining heritage, perhaps taking its cue from the nearby Harz, and as well as the preserved headstocks and winding wheels the town has a sculpture in the main street, a small mining and geological museum, and mining tubs used as planters dotted around the area. There is also an informative display panel near the main railway station.

Underground experience

The mine owner, K+S Ag, is an international concern with worldwide mining and other interests. As well as having other mines in the area, it offers a "mine experience" at its Merkers show mine just across the border in the former East Germany. Merkers was visited by a party from Sub Brit in 2001.

"Visitors are lowered 500 metres below ground in the shaft elevator, which takes only 90 seconds. Experienced miners then take them on a guided tour of the world of the "white gold", giving them a vivid insight into the eventful history of potash mining in the region and the working life of the miners. Twice a day from Tuesday to Sunday visitors are taken on a thrilling 25-kilometre long journey through the mine, which covers an area of approximately 140 square kilometres."

See www.k-plus-s.com/en/ks-zum-anfassen/ebw for more details.



Nazi treasures found in Merkers mine after the war

Winding wheel from shaft 2 has been retained as a memorial. Photo David Gordon

Memorial to mining at Bad Salzdetfurth Photo David Gordon

Efforts to save miners trapped in illegal coal pit halted, India

Roger Gosling

Rescue personnel at work in the main shaft of the mine in East Jaintia Hills, in the Indian state of Meghalaya, where 15 people were trapped on December 13 2018. Photo Sannio Siangshai

On Thursday 13 December 2018, thirteen coal miners, some from the neighbouring district of Assam, were trapped by floodwater in a 370-foot-deep coal pit in Meghalaya's East Jaintia Hills district. The accident came to light only after five miners managed to escape as water gushed inside the mine. Five days later, none of the thirteen miners had been rescued.

Survival chances bleak

On Friday 14 December the National Disaster Response Force (NDRF) officials called off the rescue operation for the day due to darkness, with officials saying that the chances of the miners' survival were bleak. The rescue attempt continued on Saturday morning without much success.

A worker in a rat-hole mine near the Lad Rymbai area in the Jaintia Hills in Meghalaya. Thin timber floors and bamboo ladders are fitted in shafts that can descend hundreds of feet. Photo Arun Sharma

Deputy Commissioner FM Dopth said, "Rat-hole mining often has many channels and tunnels deep inside, so finding the miners is a very challenging task. The mine is still filled with water and we are pumping it out but where it's coming from can only be ascertained after the water level recedes." Environmentalists have been fighting against the age-old practice of "rat-hole" mining, which is illegal.

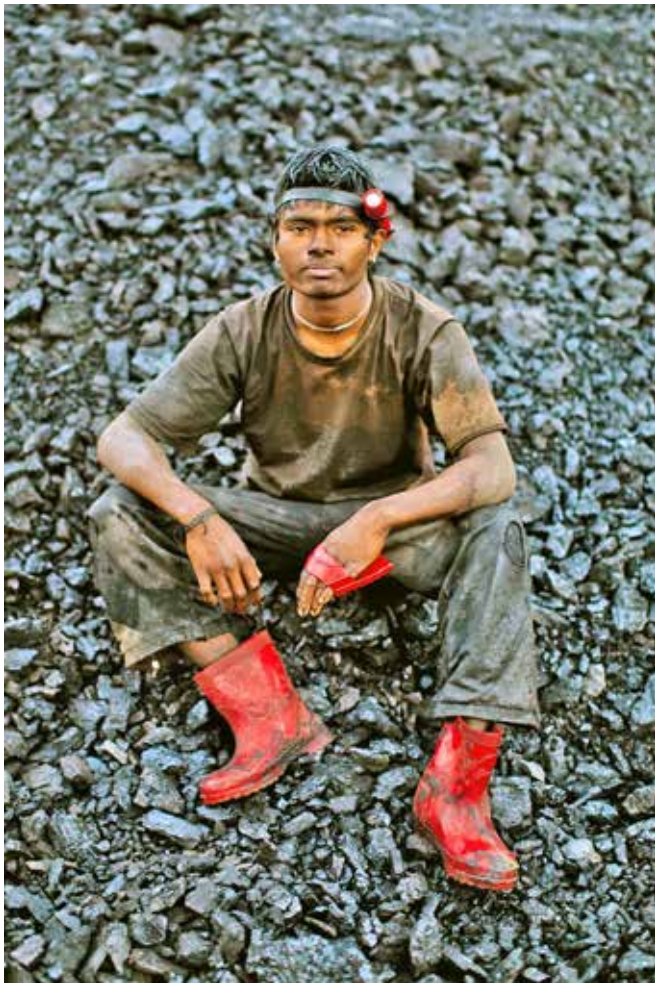
Workers are often children

Mining of coal by hand has been going on in Meghalaya for over 150 years, mostly for local use. Large-scale illegal and indiscriminate mining of the coal by private landowners and the local community started nearly three decades ago. Much of the coal mined in Meghalaya fuels chemical and steel plants in a desperately polluted industrial area outside Guwahati, the capital of Assam.

Much of the work is carried out by women seen here with baskets of coal. Photo Kevin Frayer

Nearly all mines in Meghalaya, which borders Bangladesh, use the so-called "rat-hole mining" method, even though they are not legal and authorities try to crack down on them. Workers, often children, descend hundreds of feet on bamboo ladders to dig out the coal, often leading to accidents.

A team of over 100 men were deployed to rescue the trapped miners. Rescue personnel and divers used boats to search inside the flooded coal mine. Poor visibility inside the mine and no survey of the workings made it tougher for rescuers to locate the trapped miners.



20-year-old Anil Basnet sits for a portrait above the coal mine where he works in April 2011 in Jiantia Hills, India. Photo Daniel Berehulak

The accident is significant, because a local tribunal had ordered a ban on "rat-hole" coal mining in the state from 17 April 2014. The ban rendered thousands of people jobless and affected local businesses, so, with extraction of coal tied to rights of indigenous communities over land, the ban was widely resented and challenged.

Thinness of the coal layer

The primitive method of rat-hole mining entails clearing ground vegetation and then digging pits vertically into the ground to reach a coal seam.

A typical rat-hole mine shaft. Photo Sannio Siangshai

Then tunnels are dug in sideways for the extraction of coal, which is brought out using a conical basket or a wheelbarrow. The shafts are so small that miners, including women and children, have to squeeze in and crawl on their knees to extract coal using only small implements such as pickaxes. This dangerous method is unique to the state because of the thinness of the coal layer.

"The rivers in Jaintia are all dead, creating problems for those dependent on them," bemoaned the secretary of the Meghalaya Adventurers' Association, who had filed a petition seeking a ban on mining to save Meghalaya's intricate network of limestone caves and caverns, some of the largest in the subcontinent. While limestone mining "kills" caves, digging deeper for coal also impacts them. "Where there is mining, there is deforestation and with the

It is often necessary to crawl to extract coal.

heavy rainfall seen in Meghalaya, there is heavy erosion. All this eroded soil finds its way into the caves and chokes passages. And this very acidic water that drains off from the coal mines finds its way into the caves which are home to exotic and endemic life forms," he said.

Illegal extraction

This is not the first time that labourers engaged in illegal mining of coal have been trapped in a mine. The incident has yet again exposed the rampant illegal coal extraction in the state despite the ban ordered in April 2014. At least fifteen miners were trapped in an illegal rat-hole coal

Two miners drag a cart of coal out of a rathole mine south of Shillong. The coal face is at the end of a tunnel over one kilometre long. It takes miners an hour to trudge to the coal face, an hour to mine and fill the cart, and an hour to pull the cart with $2 worth of coal back to the mine entrance

mine in South Garo Hills in 2012 when an underground stream flowing near the mine flooded it. Their bodies were never recovered.

These two incidents are similar to the much nearer home Gleison mine incident in South Wales in 2014 when four miners died due to an inrush of water from an old mine.

This article has been compiled from a number of sources including Wikipedia.

Very short-lived tunnels

Some tunnels, often in hard rock, were once made in connection with civil engineering, military and quarrying operations. A well-documented example was the removal of Round Down on the east Kent coast to facilitate the construction of the South-Eastern Railway between Folkestone and Dover in the early 1840s, an event which attracted hundreds of spectators. A tunnel was driven in at the foot of the chalk cliffs, communicating with two shorter tunnels at right-angles. The short tunnels were packed with gunpowder, and the long tunnel back-filled. Detonating the gunpowder demolished Round Down where, otherwise, full-size railway tunnelling might have been required (building the Folkestone-Dover line called for tunnelling at Abbotscliffe and Shakespeare Cliff). A similar exercise was employed by the military near Newhaven in East Sussex. Between the 1930s and 1950s this approach was used in opencast quarries for hard rock to bring down large quantities of broken stone for use as aggregate. At the granite quarries at Shap in Cumbria 'heading blasts' were used to bring down 80,000 tons or more of rock. One such blast called for a 14 metre tunnel communicating with side tunnels to be packed with explosives 6.7 and 14 metres long. A photograph taken inside the access tunnel has been published in David Johnson's book *Quarrying in Cumbria* (2018), page 78.

Round Down Cliff following the explosion on 26 January 1843. Painted by William Burgess

Cave Rescue at Godstone in east Surrey

Paul W. Sowan

Main haulage gallery in Godstone Hill quarry. The lost children were found at the south end of this gallery. Photo Nick Catford

Some time during the early afternoon on Saturday 6 June 1987, a number of teenagers took it into their heads to go exploring in the extensive network of underground quarry galleries under Godstone Hill. Unfortunately the locked entrance had previously been vandalised so they had no difficulty in getting in.

They had no protective headgear, an essential item of equipment for exploring several miles of tunnel with very low ceilings and a number of places where crawling through restricted places through roof falls is necessary. Nor did they have adequate lighting even (it seems) for a short underground trip. Some of the children, at least, had visited the quarry previously (all were local from the Caterham and Godstone areas).

They were evidently not as familiar with the system as they supposed, and were almost certainly not aware that at some time between the 3rd and the 9th of May a major roof fall had reduced the available routes into the main workings from two to one. It appears that some of the party thought better of the excursion and went out later that afternoon, whilst six others went on further into the underground maze. During the evening, the parents became concerned at their children's failure to return home.

The entrance to Godstone Hill quarry as it was in 1930. By 1987 the left entrance has collapsed. The children had to drop through a hole in the bank above the right entrance. Photo J Rhodes ©British Geological Survey - Ref: P205257

Those youngsters who had decided against an extended underground visit, on being contacted as friends likely to be able to throw some light on the matter, volunteered the information that the missing children had gone into the quarries. So evidently another important safety rule for underground exploration had been broken … Always make

sure that someone responsible on the surface knows exactly where you are going and when to expect your return.

The parents of the missing children contacted the Police who in turn contacted Malcolm Tadd of Unit 2 Cave Research & Exploration at about 12.30 am on Sunday morning. Malcolm was at the time the local liaison officer for the South Eastern Cave Rescue Organisation, and it was his function to alert a team of local cavers with first-hand knowledge of the Godstone quarries.

There are many roof falls in Godstone Hill quarry. Here the roof of a heavily timbered gallery has collapsed. There were two routes out of the quarry but shortly before the children visited one of these routes had been blocked by a major fall. Photo Nick Catford

Chris Bayley, Peter Burgess and Paul Sowan (who, with others, were currently surveying the Godstone Hill system) were high on the call-out list and amongst the first to arrive at the quarry entrance. There they discovered several police officers and several parents of missing children.

At least four children, and possibly more, were reported missing. With at least one caver remaining at the entrance to coordinate the search and liaise with the emergency services, Chris and Paul entered the quarry to make a rapid search of the missing children's most probable locations. It was agreed that, in the event of their not finding the children, they would rendezvous with a second posse of cavers, on their arrival at an agreed location underground for a more exhaustive and systematic search.

Chris and Paul then took two main routes to the old main quarry entrance under the A22, where a vertical shaft now communicates with a locked manhole cover on the roadside verge. They reasoned that the lost children had failed to find their way out through the maze and roof-falls to the open entrance, but had managed to find the shaft through which the sound of passing cars was clearly audible.

This reasoning proved correct. As the searchers approached the foot of the shaft, the distinct smell of chewing gum became stronger and stronger! Six children were discovered, very cold and cramped, wedged into the shaft where they had been for some hours, attempting to attract attention on the underside of the manhole cover.

The children were eventually found wedged into the shaft through the grille. Photo Roy Harper

Few pedestrians walk up and down Godstone Hill and even fewer after midnight!

The teenagers had no helmets, and just one exhausted torch between them. Before commencing the underground search, the cavers had requested arrangements to be made for opening the manhole (keys are kept with the emergency services), so shortly after the children's discovery, the roadside entrance was opened allowing a short cut to freedom.

Chris went back through the system to meet the other underground searchers as arranged, to ensure all cavers surfaced. Paul superintended the evacuation of the children via the shaft, liaising with the fire brigade. A life line was used in view of the awkward climb of seven metres or so. The youngsters were reunited with their parents and went home via hospital as a precautionary measure … but not until they had received some well chosen words of wisdom from the cavers and emergency services.

This article was first published as Children lost in Godstone Quarries. *Newsl. Chelsea Spelaeological Society* 30(2), 23–24.

Postscript

The event described above was the subject of news items in a number of national newspapers, remarkable for the contrasting and inaccurate 'details' in them. The source or sources used by the several papers is not known: they seem not to have been members of the caving club.

The message here is that for any news story dealing with matters on which you are well-informed, errors are usually present. The maxim 'I read it in a book, it must be true' is even less reliable where newspapers are concerned. Newspaper reporters are rarely in possession of much knowledge or understanding of the items they report in the press.

Interestingly, one of the youngsters 'rescued' in June 1987 revisited the Godstone quarries, reportedly containing eight miles or so of low crumbling passages, some years later as part of a group being shown around by the caving club, in the company of what seemed to be his girlfriend. The rescue saga being told, this young man volunteered that he had been one of the lost children.

Cave Rescue Practice at Chaldon / Merstham in east Surrey

Paul W. Sowan

Members of Unit 2 Cave Research & Exploration, now the Wealden Cave & Mine Society (WCMS), have from at least the 1960s made detailed and accurate surveys of most of the accessible underground mine and quarry sites of east Surrey and also, with other clubs, form part of the South Eastern Cave Rescue Organisation (SECRO).

SECRO have undertaken many rescue practices at Bedlams Bank, Merstham. The quarry galleries are less than 5 feet high and strewn with rubble. The scale seen here is 2 feet in length. Photo Nick Catford

999 telephone calls to the emergency services reporting persons believed to be lost underground are relayed to SECRO, and it is caving club members who do the underground searches, as ambulance crews, firefighters and the police are rarely appropriately equipped or experienced for the task. And local cavers, of course, are familiar with the underground labyrinths. Other Cave Rescue groups operate similarly throughout the country.

There are regular SECRO cave rescue practices in the more extensive mine and cave complexes in the Godstone and Merstham areas. Two current Subterranea Britannica committee members have had parts to play in some of these practices in the past: Nick Catford and Paul Sowan.

The practices are elaborately planned and coordinated, with operational details on the day kept confidential from club members who may be led to expect a routine underground trip. The 'victim' is informed of his or her role at the last moment, often once the underground visit has commenced.

Paul Sowan, for example, recalls having been told that his role was to pretend to be an irresponsible teenager escaping unobserved from the group and deliberately setting off through the mine as far as possible, and

SECRO rescue practice at Bedlams Bank, Merstham. Here access into the quarry is down a 12 foot vertical shaft. Photo Peter Burgess

hiding in some obscure nook or cranny. He was noticed to be missing from the organised group and located surprisingly quickly!

Searching is made the more challenging by the fact that sound travels very poorly in the crumbling soft rock passages. For organised group visits, there is a leader (who knows his or her way around) and a similarly knowledgeable back-marker whose job it is to see that nobody gets left behind. Another practicality is that apart from the maze of less-than-walking height tunnels, many of the routes involve crawling on hands-and-knees and sometimes even flat-out.

During a search the mine is divided into discrete sectors to be searched exhaustively with no time wasted searching any part twice. Paul recalls searching a maze of low crawls near the Bedlams Bank entrance in a triangle between the main routes to the east and west end of the complex and the working faces; this was quite exhausting especially if searched at speed.

Nick undoubtedly remembers being the 'victim' on one occasion in the same quarry when he had to play the role of an injured person who was to be stretchered out through such a very low maze. The stretcher bearers no doubt also remember the occasion!

Brooklyn Bridge Bunker New York

Sewell Chan

Brooklyn Bridge over the East River in New York was completed over 130 years ago in 1883 and was the first steel-wire suspension bridge ever constructed. Billions of people have crossed the bridge throughout its history and thousands still cross it each and every day.

City workers were conducting a regular structural inspection of the bridge in March 2006 when they came across a Cold War bomb shelter with a hoard of water drums, medical supplies, paper blankets, drugs and calorie-packed crackers — an estimated 352,000 of them, sealed in dozens of watertight metal canisters and boxes.

A large number of cardboard boxes are stacked in the shelter. Photo Seth Wenig

Inside the vault, a dank and lightless room, the walls are lined with dusty boxes. The shelter is a vivid reminder of the anxieties that dominated American life during the military rivalry with the Soviet Union, an era when air-raid sirens and fallout shelters were standard elements of the grade-school curriculum.

Significant dates

Many of the cardboard boxes of supplies are ink-stamped with two especially significant years in Cold War history: 1957, when the Soviets launched the Sputnik satellite, and 1962, when the Cuban missile crisis seemed to bring the world to the precipice of nuclear destruction.

Civil defence agencies were building fallout shelters all over the country during the 1950s and stocking them with supplies of food and water and other stores. Most of these have been dismantled; the crackers got mouldy a very long time ago. It's unusual to find one fully intact.

The Department of Transportation, which controls the bridge, immediately secured the site while deciding what to do with the trove of supplies. The Department of Health and Mental Hygiene was contacted to handle the drugs, which include bottles of Dextran, used to treat or prevent shock.

Survival crackers

The shelter is within one of the arched masonry structures under the main entrance ramp to the bridge, not far from the Manhattan anchorage. The most numerous items are the boxes of Civil Defense All-Purpose Survival Crackers. Printed in block letters, on each canister, was information about the number of pounds (6.75), the number of crackers per pound (62) and the minimum number of crackers per can (419). There were 140 boxes of crackers — each with six cans, with a total of some 352,000 crackers.

The metal canisters at one time contained drinking water. Photo Alison Grippo

Nearby were several dozen boxes with sealed bottles of Dextran, made by Wyeth Laboratories in Philadelphia. More mysterious were about fifty metal drums. According to the label, each was intended to hold 17.5 gallons and to be converted, if necessary, for "reuse as a commode". They are now empty.

Several of the boxes in the room have labels from the Office of Civil Defense, a unit of the Pentagon that coordinated domestic preparedness in the early 1960s. State and local governments often appointed their own civil defense coordinators.

In 1950, the city's Office of Civil Defense, the predecessor to today's Office of Emergency Management, was formed to prepare for a possible atomic attack. In 1951, during the Korean War, floodlights and barbed-wire barriers were set up on and around the city's bridges, and bridge operators were organised into defence batteries, as part of an overall civil defence strategy aimed at deterring sabotage.

Mayor Robert F. Wagner, who served from 1954 to 1965, appointed several civil defence advisers. In 1959, a federal report concluded that two hydrogen bombs dropped near the Brooklyn Bridge would kill at least 6.1 million people.

One of the rooms on the Brooklyn side that was used for storage until 2001. Photo Paul Fitzpatrick

In addition to the bomb shelter, there are eight big rooms on the Brooklyn side. At one time there were plans to turn the rooms into shopping and arcade spaces. Instead they were used for storage up until 2001 when they were closed for security reasons.

Earthquakes and underground places in Britain

Paul W. Sowan

Those who explore underground, especially in abandoned mines more than well-provided with unstable looking ceilings, often wonder what effect an earthquake might have on them. And Moore (2000) has questioned the risk of earthquake-induced mass collapses in the chalk mines under Emmer Green at Reading. The answer is known: not very much!

Standing structures are more at risk than underground excavations. The reason is, probably, that tall buildings and especially chimneys are, whilst fixed to the ground at their lower extremities, unrestrained and free to wobble at the top. Whereas a mine tunnel, for example, is in effect a rigid framework all parts of which move as a whole.

Britain has earthquakes, although usually no more damaging then the chimney-pot toppling kind. The only one I have felt in over 70 years was the North Wales earthquake of 19 July 1984. The building I was in at the time, in Liverpool, wobbled very slightly before breakfast that morning.

Britain's most destructive recorded earthquake was at Colchester on 22 April 1884, when 1,200 buildings within an area of 150 square miles were damaged. That earthquake was felt as far away as Boulogne and Ostend. It had been preceded by a slight shock on 18 February earlier in the same year. The most recent widely noticed earthquakes in London were in 1750.

St. Mary's Church, Peldon, looking south. Peldon Church was situated over the epicentre of the 1884 Colchester earthquake. Many other churches and buildings suffered severe damage or destruction. This church, though 'spilt in twain', was saved from complete ruin, its bricked-up nave bearing mute evidence of the extensive repair work entailed. Photo © UKRI/BGS

Effects of earthquakes recorded in mines

Charles Davison (1858–1940) compiled a very detailed account of British earthquakes, published in 1924, and noted the following examples of earthquakes recorded in mines. In each case the sound of the earthquake and/or an earth tremor were recorded.

Bolton (Lancashire), 10 February 1889

The shock was felt in a mine at Ince (near Wigan) and the sound was heard (apparently in the roof) in one of the workings of the Pendlebury colliery, and also in a mine at Agecroft.

Derby, 24 March 1903

This earthquake was of magnitude 7 on Davison's scale, so 'ornaments, vases, etc' were overthrown in surface buildings. There appear to have been two shocks and two centres, in the neighbourhoods of Ashbourne and Wirksworth, northwest of Derby.

The earthquakes passed unnoticed in the pits at Cannock Chase, but were 'perceived' in mines as far as Bucknall near Stoke-on-Trent (19 miles from the centre), at Monsal Wade near Buxton (18 miles, 117 yards deep), Eckington (22 Miles), Hucknall Torkard (20 miles, 500 yards deep), Bulwell (20 miles, 300 yards deep) and towards the south at Swadlincote (20 miles, 470 yards deep). Davison further records that …

> 'The general impression produced by the earthquake was that an explosion or fall of rock had occurred in some distant part of the mine. In the pits at Clay Cross and Morton (between Alfreton and Chesterfield) both parts of the shock were felt, the first part being the stronger, and, at Clay Cross, accompanied by the louder noise. In three pits, at Glapwell, Pilsley and Swancote (all in the Alfreton district), the shock was strong enough to detach small pieces of shale from the roof. The sound differed slightly from that observed on the surface, in being less intermittent and more monotonous.
>
> The observations lead to the following conclusions: (i) the shock, as a rule, was not felt in the more distant mines; (ii) in several cases, the sound appeared to be overhead rather than below; for instance at Clay Cross, Manners colliery (near Ilkeston), Pilsley and Swadlincote, the sound was that of a train passing overhead; (iii) at Swadlincote (near Burton-on-Trent), the sound was not heard at all at a depth of 220 yards; in a seam 350 yards from the surface, it was heard by some men but attracted little notice; at a depth of 400 yards the men were alarmed by a rumbling noise passing overhead, like a railway train going over a wooden bridge; and, lastly, in a seam 470 yards deep, a heavy rumbling noise was heard; thus, the intensity of the sound seems to have increased with the depth.

Derbyshire, 18 November 1795

This was the strongest of all recorded earthquakes in Derbyshire, intensity 8 on Davison's scale (chimneys thrown down and cracks made in the walls of some houses). The exact location of the epicentre (the point on the earth's surface directly above the earthquake centre)

is undetermined, but a number of chimneys fell in Derby, Nottingham and Ashover. The shock was felt by men working in lead mines near Chesterfield. In the Gregory mine at Ashover, the noise seemed to pass through the strata above the workings.

Helston (Cornwall), 17 February 1842

The shock was felt in many of the nearby mines, including those of Poldory (130 fathoms deep), Tresavean (near Redruth) at all the depths worked, Wheal Vyvyan (near Constantine, 20 or 30 fathoms), Wheal Vor (near Helston, 80 and 175 fathoms), Penhale (near Helston, 50 fathoms), Great Work (near Godolphin), Wheal Penrose (near Porthleven), and West Wheal Virgin (near St Hilary, 100 fathoms). The sound was also heard in the Wheal Vor, Great Work, Wheal Penrose, and West Wheal Virgin mines, in the last named resembling the noise made by a shaft crushing in. The area disturbed underground was thus almost the same as that on the surface …

Hereford, 17 December 1896

This earthquake was felt in an area extending from South Wales to Shropshire, in the following mines: Trafalgar near Mitcheldean (14 miles from the centre), Parkend and Whitecroft near Lydney (19 and 20 miles), Madeley near Ironbridge (42 miles), Wattstown in the Rhondda Valley (44 miles), and Chasetown near Walsall (54 miles). A rather strong shock was felt in the first-named pit, and a tremor in that of Whitecroft. In all cases, a sound was heard, which usually resembled that made by one or several loaded coal-wagons running down an incline.

Penzance (Cornwall), 15 July 1757

The first published detailed study of a British earthquake was that of William Borlase (1695–1772), author of an account published in the *Philosophical Transactions of the Royal Society* in 1759.

This earthquake affected most of Cornwall, and was felt strongly in the Scilly Isles so doubtless also disturbed the sea-bed westwards of there. The epicentre appears to have been near Penzance. At St Agnes, according to John Wesley, there was first a rumbling noise underground, 'hoarser and deeper than common thunder'; then followed a trembling of the earth, which afterwards waved violently to and fro once or twice. The shock was felt in mines near St Just, Lannant, and Godolphin; in others near Gwinear and Chacewater, the noise only was observed, 'as if the loose rubbish of the mines was set in motion'.

Swansea, 27 June 1906

The country affected by the Swansea earthquake included one of Britain's most important coalfields. It was felt in 39 mines throughout an area extending for 49 miles from Kidwelly to near Pontypool. In eight pits in the Rhondda 'the heaving of the floor was distinctly perceived'. In others, the shock was a mere tremor'. The area most affected comprised about 56 square miles. Davison provides further details as follows:

> The sound observed in the mines differed slightly from that heard on the surface. It was compared to passing waggons, etc., in 54 percent of the records, thunder in 12, wind in 2, loads of stones falling in 5, the fall of a heavy body in 5, explosions in 17, and miscellaneous sounds in 5 percent. The sound was evidently more uniform and monotonous underground than on the surface, although loud explosive crashes which accompanied the strongest vibrations were occasionally heard.
>
> The observations made in the mines lead to the following conclusions: (i) the shock and sound were observed underground over the same area; (ii) in pits not more than 5 miles from the nearest epicentre, the sound seemed to pass below the workings, in those at a greater distance, as a rule, to pass overhead or to travel along the workings; and (iii) the shock appears to have been felt more severely in the lower than in the upper workings of a pit.

Truro (Cornwall), 21 October 1859

This earthquake was felt throughout much of Cornwall, and felt and heard in the Wheal Ellen mine at St Agnes, and also in mines near St Austell.

Truro (Cornwall), 13 January 1860

This earthquake was felt in much of Cornwall, although not in the Scilly Isles. It was felt by men from 10 to 190 fathoms down in mines at Redruth, 208 fathoms down at Gwennap, and near Par. The sound was heard in mines as far west as Lelant and St Ives, a slight trembling at the latter place being also felt at a depth of 130 fathoms.

From the above records, it can be concluded that although the energy released in even a small earthquake is enormous (sufficient to shake an entire county and more), and that to experience an earthquake underground might undoubtedly be alarming, the only mechanical effects recorded in the mines themselves have been the mine floor 'heaving' in South Wales, and a few fragments of shale falling from a mine ceiling in Derbyshire.

In The Netherlands an earthquake having its epicentre near Roermond some years ago caused some damage to buildings in and around Maastricht but, Joep Orbons has told me, appears to have had no effect on the numerous and very extensive underground limestone quarries in Zuid Limburg and adjoining areas in Belgium.

It seems you are likely to be safer underground during a British earthquake than anywhere near a chimney-pot at the surface!

Earthquake-like tremors caused by collapses in mines

Although roof-falls in mines appear not to have been recorded as caused by earthquakes, earthquake-like tremors have often been observed as the result of collapsing mine-workings. These effects are perhaps commonest in the coalfields, where many square miles of coal seams have been mined-out over centuries.

Davison catalogued numerous reputed earthquakes (or 'earth-shakes' as he called them), caused by collapses in mines, in and around coalfields in northeast England, Barnsley, Kilsyth (Stirlingshire), Leeds, Pendleton and South Wales, and also events related to metalliferous mines in Cornwall.

Redmayne *et al*. (1998) have reported on 247 accurately located 'earth-shake' events clearly spatially and temporally associated with concurrent coal mining in the area around Rosslyn Chapel between November 1987 and January 1990, noting a rapid falling-off following pit closures.

Similar shocks with shallow foci in and around Sunderland have been attributed to collapses of the Magnesian Limestone into cavities dissolved naturally by groundwater in underlying 'evaporite' deposits such as gypsum and rock salt. The rock-salt mining area of Cheshire, and especially the town of Northwich, has been notorious for ground subsidence and extensive damage to property resulting from surface water penetrating the mine workings (via mine shafts sunk through impervious rock) and dissolving the roof-support pillars left by the miners.

In The Netherlands again (and in adjoining countries) seismometers recorded earth tremors caused by the collapse of part of an extensive underground quarry at Valkenburg (in fact, one visited by Subterranea Britannica members some years before).

Is anywhere in the UK earthquake-proof?

Earthquakes are the perceived effects at the surface of the earth of large masses of rock, subjected to huge forces, being dislocated or broken. The plane of breakage is known (if steeply inclined) as a fault or, if more flat-lying, as a thrust-plane. The rocks either side may move laterally or vertically by anything from a yard or less to hundreds or thousands of yards or more. Once such a fault or thrust has formed, the rocks either side may move again at intervals.

Witton Hall Rock Salt Mine, Northwich. The interior of the mine photographed by electric light in 1882. Photo © *UKRI/BGS*

The San Andreas fault in northwestern California is a break in the earth's crust some 600 miles long, the rocks on either side of which are reputedly moving in opposite directions at about half an inch a year. From time to time the built-up tension is released and an earthquake results. That of 1906 wreaked much damage in San Francisco, and there have been subsequent earthquakes in 1989, 1993 and 1994.

In the British Isles it has been estimated that the rocks either side of the Great Glen Fault (Inverness to Fort William) have moved relative to each other by some tens of miles, and this is responsible for the Great Glen (and of course Loch Ness). Similarly, the Moine Thrust has pushed a mass of northern Scotland over the older rocks (Pre-Cambrian gneiss) of the northwest of that country.

But faults and thrusts exist all over England, some detectable at the surface and some (such as the New Addington Thrust in south London) deeply buried under younger rocks. If Britain's most destructive recorded earthquake can occur in such a geologically quiescent area as Essex, such an event could recur anywhere in the country!

Davison's 1924 catalogue of 1,191 earthquakes includes the following recorded for London and Hampshire, the Isle of Wight, Kent, Surrey and Sussex …

Date	County	Location
1247 (13 February)	London	London
1382 (21 May)	Kent	Canterbury
1551 (25 May)	Surrey	Reigate – Croydon
1553	Hampshire	Southsea
1580 (6 April)	London	London and Kent
1580 (1 May)	Kent	Ashford
1601 (24 December)	London	London
1638	Sussex	Chichester ('great damage')
1707 (25 October)	Sussex	Chichester
1726 (25 October)	London	London
1734 (25 October)	Hampshire	Portsmouth
1734 (25 October)	Hampshire / Sussex	Portsmouth – Chichester – Lewes
1750 (19 February) (1st)	London	London
1750 (19 February) (2nd)	London	London
1750 (19 March) (1st)	London	London
1750 (19 March) (2nd)	London	London
1750 (20 March)	London	London
1750 (29 March)	Hampshire	Portsmouth
1750 (30 March)	Isle of Wight	Newport
1750 (6 April)	Isle of Wight	
1750 (18 September)	Hampshire / Isle of Wight	Portsmouth
1756 (1 June)	Kent	Ashford
1758 (24 January)	Surrey / Kent	Kent / Surrey / Sussex borders
1758 (20 December)	London	London
1776 (27 November)	Kent	Canterbury
1811 (30 November)	Sussex	Chichester

1814 (6 December)	Sussex	Chichester
1821 (1 February)	Sussex	Alfriston
1824 (6 December)	Sussex	Chichester
1831 (2 March)	Kent	Dover
1833 (18 September)	Sussex	Chichester
1833 (13 November)	Sussex	Chichester
1833 (13 November)	Sussex	Chichester
1834 (23 January)	Sussex	Chichester
1834 (20 February)	Sussex	Chichester
1834 (27 August)	Sussex	Chichester (chimney-pots toppled)
1834 (5 October)	Sussex	Chichester
1835 (12 January)	Sussex	Chichester
1835 (3 August)	Sussex	Chichester
1848 (19 October)	Kent	Sandwich
1860 (3 September)	Kent	Maidstone
1864 (30 April)	Sussex	Lewes
1864 (21 August)	Sussex	Lewes

Acts of God?

Earthquakes do not, of course, respect administrative boundaries. And records which have survived were necessarily made by those capable of writing, which in part probably explains the prominence of the cathedral city of Chichester in the list. And earthquakes were commonly seen not just as 'Acts of God' (as defined by insurance companies) but acts of vengeance by a wrathful god sent as punishment for the misdemeanours of mankind.

Thomas Sherlock (1678–1761), the then Bishop of London, published a tract prompted by two of the London earthquakes of 1750, putting them forward as retribution for the depravity of Londoners who had, amongst other things, attended dramatic and operatic performances, watched cock-fighting and boxing during Lent, and read novels the contents of which were 'vile abominable pictures of lewdness' (so presumably he had also read them to ascertain this!).

A view of the sea cliffs and coastal hills from the Isle of Purbeck (Dorset) through to the Isle of Wight and Portsdown (Hampshire) provides ample evidence that this is indeed a zone where large earth pressures have tilted and up-ended the chalk strata.

Since the publication of Davison's treatise in 1924, of course, earthquakes have continued to disturb the British Isles, including *inter alia* in recent years those at Dudley (2002), Folkestone (2007), Glasgow (1964), Manchester (2008), Market Rasen (2008) and Somerset (2004).

Pause for thought

The British Geological Survey keeps records of even the slightest tremors affecting our islands, some of them true earthquakes but others recording events such as nuclear weapons tests. Roger Musson suggests London might before long suffer another clutch of tremors such as occurred in 1750. Jessica Rowson (2008) has proposed that new UK buildings should be designed to withstand earthquake shocks.

What the effects of a sizeable tremor might be on our numerous very tall glass-clad tower blocks is an interesting question. When such a day arrives, a cosy mine tunnel in east Surrey might be a better place to be than London Bridge Station, the City of London, or central Croydon!

BGS broadband seismic station in former ROC monitoring post, Wroughton,Wiltshire. Photo © *UKRI/BGS*

Main Source: DAVIES, Graham L. 1964, Robert Hooke and his conception of earth-history. Proceedings of the Geologists' Association 75/4, 1964, Pages 493. 498 (Hooke's discourse of of 1668)